



April 25, 2014

Via Electronic mail (CommActUpdate@mail.house.gov)

Committee on Energy and Commerce
House of Representatives
United States Congress
2125 Rayburn House Office Building
Washington, D.C. 20515-6115

Re: Mobile Future Comments on Modernizing U.S. Spectrum Policy

Dear Members of the Committee on Energy and Commerce:

Mobile Future appreciates this opportunity to provide comments on the Committee's second white paper regarding modernizing U.S. spectrum policy, which poses several important questions. These comments focus on a subset of those questions that raise issues most critical to Mobile Future's members, including cutting-edge technology and communications companies.

Consumer demand in the U.S. is skyrocketing for mobile broadband technology and services. Last year, the average U.S. consumer used 1.2 gigabytes of data per month over cellular networks, nearly doubling the average of 690 megabytes per month in 2012.¹ Some American wireless users are now generating, on average, 4 gigabytes per month on their devices.² There is also a sharp increase in the number of machines connecting wirelessly to the Internet with significantly more data traffic on the horizon from the Internet of Things. This high data consumption ranks American consumers behind only Japan in average monthly data usage.³ In 2013, worldwide mobile traffic reached 1.5 exabytes (1 billion gigabytes) per month, up from

¹ Brian X. Chen, *U.S. Mobile Internet Traffic Nearly Doubled This Year*, N.Y. Times, Dec. 23, 2013, <http://bits.blogs.nytimes.com/2013/12/23/u-s-mobile-internet-traffic-nearly-doubled-this-year/>.

² Chetan Sharma, *The year in mobile*, Chetan Sharma Consulting (Dec. 23, 2013), <http://www.chetansharma.com/blog/>.

³ Hailey Robinson, *The Gigabyte Era: America's Role as the Leading Mobile Data Consumer*, Tech Cocktail LLC (Mar. 30, 2014), <http://tech.co/yes-gigabyte-era-americas-role-leading-mobile-data-consumer-2014-03>.

820 petabytes per month in 2012.⁴ And wireless data usage is expected to increase eightfold by 2018.⁵

To respond to growing consumer demand, Congress, the Federal Communications Commission (“FCC” or “Commission”), and Federal agencies must strive to ensure that spectrum resources are made available consistently to all competitors that have the desire and ability to put that spectrum to use. There are a number of steps policymakers should take:

- Repurpose underused Federal spectrum for non-Federal use, providing an additional stream of spectrum. The majority of the spectrum best suited for mobile broadband is allocated for primary use by Federal agencies. More efficient use of that spectrum is a critical component to addressing consumers’ need for additional spectrum. To that end, policymakers must develop and implement more effective mechanisms to encourage efficient Federal spectrum use and to enable repurposing of that spectrum for exclusive commercial use to serve consumers.
- Develop a nimble approach to FCC licensing and secondary market transactions to foster innovation and investment.
- Update the Commission’s spectrum screen for evaluating spectrum aggregation.
- Allocate spectrum for licensed and unlicensed (in higher frequency bands) use as invaluable complementary tools to address spectrum demands.

We must develop meaningful incentives for efficient Federal spectrum use.

Effective incentive mechanisms are essential to fostering efficient spectrum use by Federal users. While Congress, the Administration, and Federal agencies are making some strides in encouraging efficient spectrum use, there is still much to be implemented. For instance:

- The Middle Class Tax Relief and Job Creation Act of 2012⁶ established a preference for agencies relinquishing Federal spectrum for exclusive commercial use, and stated that sharing arrangements should be used only where relocation is not technically or financially feasible.⁷
 - The National Telecommunications and Information Administration (“NTIA”) and the Office of Management and Budget (“OMB”) should develop a consultation process regarding the relinquishment or sharing of specific Federal spectrum bands.
 - NTIA must justify its conclusion that a particular band cannot be repurposed for exclusive use, as required by the 2012 Spectrum Act, before Government looks to sharing.

⁴ Cisco, *Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2013-2018*, at 1 (Feb. 5, 2014) (“Cisco White Paper”), http://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/white_paper_c11-520862.pdf.

⁵ Cisco White Paper at 12.

⁶ Middle Class Tax Relief and Job Creation Act of 2012, Pub. L. No. 112-96, 126 Stat. 156 (2012) (“2012 Spectrum Act”).

⁷ 47 U.S.C. § 923(j).

- OMB revised its Circular No. A-11 pursuant to the 2012 Spectrum Act⁸ to require agencies to consider the economic value of spectrum in their budget justifications for procuring communications systems, as well as alternatives to those systems.⁹
 - OMB should require agencies to demonstrate why a proposed system is the most efficient of those considered, why the system cannot be operated on spectrum shared with other federal users, and why the agency cannot use a commercial system. Congress should use its oversight power to obtain insight on whether this process is working as intended.
- President Obama’s June 2013 Memorandum “Expanding America’s Leadership in Wireless Innovation,”¹⁰ included several directives to NTIA, including (i) to require agencies seeking spectrum in the 400 MHz – 6 GHz range to verify that they cannot meet their spectrum needs through other spectrum or other means, and that they will use the minimum amount of spectrum necessary, and (ii) to require agencies to assess their spectrum use and then make recommendations regarding availability of spectrum for commercial use.¹¹
 - NTIA should implement each of these directives and Congress should use its oversight authority to gain insight into their effectiveness.

Beyond implementing existing requirements, more work must be done to meet booming consumer demand for spectrum-reliant services. Existing Federal spectrum management policies do not create adequate incentives for efficient government use. New incentives should enable agencies to recover the costs of relinquishing or sharing Federal spectrum, closing the gaps within existing laws.¹² New mechanisms also should provide agencies with additional financial incentives and/or operational benefits (*e.g.*, updated technology, additional functionality) from those efforts. The 2012 Spectrum Act states a clear preference for relinquishing spectrum,¹³ so mechanisms should prioritize spectrum clearing over sharing and further prioritize lower-band spectrum (*e.g.*, by paying higher benefits to agencies that relinquish lower-band Federal spectrum for exclusive commercial use). In addition, exclusive use spectrum is most likely to generate revenues that can fund agency incentive mechanisms and relocation efforts, as well as provide funds for the Treasury. Where relocation is not technically feasible, agencies should first be encouraged to share spectrum with other agencies to increase spectrum efficiency and potentially clear a portion of Federal spectrum for exclusive commercial use. After that, Federal and non-Federal sharing should be encouraged, with such arrangements being targeted to higher-band spectrum. Spectrum sharing, however, is not a silver bullet. While sharing technologies exist, much work remains to be done to advance to more sophisticated sharing approaches. As

⁸ See Office of Management and Budget, Circular No. A-11: Preparation, Submission, and Execution of the Budget (Aug. 2012) (“OMB Circular No. A-11”).

⁹ OMB Circular No. A-11 at Sections 31.12 and 51.18.

¹⁰ Presidential Memorandum, *Expanding America’s Leadership in Wireless Innovation*, 78 Fed. Reg. 37431 (June 20, 2013) (“June 2013 Presidential Memorandum”), <http://www.gpo.gov/fdsys/pkg/FR-2013-06-20/pdf/2013-14971.pdf>.

¹¹ June 2013 Presidential Memorandum, 78 Fed. Reg. at 37433 (Section 3(e)).

¹² For example, while the 2012 Spectrum Act amended the Commercial Spectrum Enhancement Act (“CSEA”) to permit recovery of spectrum sharing costs (47 U.S.C. § 923(g)), that provision only applies to auctioned spectrum, and also does not allow an agency to improve its functionality unless such improvement is incidental. 47 U.S.C. § 923(g)(3)(B)(ii).

¹³ See *2012 Spectrum Act*, § 6701.

Rysavy Research explained in the recent paper “Complexities of Spectrum Sharing: How to Move Forward,” the complex spectrum management systems envisioned involve development of “new architectural concepts, protocols, interfaces, stringent security, and policy-enforcement methods.”¹⁴ Thus, sharing is not a short- or intermediate-term solution.

In addition, OMB and NTIA should play significant roles to encourage spectrum efficiency through the procurement and budget processes. For example:

- NTIA should implement the cities pilot program to monitor Federal spectrum use, and should institute an annual review of Federal spectrum holdings and use.¹⁵
- NTIA should develop and implement spectrum efficiency guidelines in the budget and procurement processes for all agencies, as required by the June 2013 Presidential Memorandum.¹⁶
- OMB should be permitted to use its influence in the appropriations process to encourage more efficient spectrum management, *e.g.*, as recently proposed in the Science & Technology Policy Institute report prepared for the Spectrum Policy Team created by the June 2013 Presidential Memorandum.¹⁷ In addition, OMB should require agencies to file annual “report cards” demonstrating progress made on making additional Federal spectrum resources available for commercial use.

Finally, Congress can promote efficiency in other ways. For example, it should consider using spectrum auction revenue to create an “efficiency endowment fund” to cover agency costs to experiment with new technologies or systems that would enable them to relinquish Federal spectrum. Without such funding and targeted budgets for these initiatives, agencies have little incentive to incur the costs and risks associated with such system and process upgrades.

The FCC should continue to issue flexible use licenses.

The FCC should continue issuing flexible use licenses as opposed to command-and-control regulation specifying the permitted services. Flexible use licensing enables the whole mobile ecosystem – from service providers to equipment manufacturers to application developers – to innovate to make new products and services available to consumers. The Commission can continue to protect licensed users from harmful interference by developing appropriate technical operating rules.

¹⁴ Peter Rysavy, Rysavy Research, *Complexities of Spectrum Sharing: How to Move Forward*, at 3 (Apr. 2014), available at <http://mobilefuture.org/wp-content/uploads/2014/04/Spectrum-Sharing-Paper-2014.pdf>.

¹⁵ June 2013 Presidential Memorandum, 78 Fed. Reg. at 37432-33 (Sections 3(a), (b) and (c)).

¹⁶ June 2013 Presidential Memorandum, 78 Fed. Reg. at 37434 (Section 4).

¹⁷ Karen D. Gordon *et al.*, IDA Science & Technology Policy Institute, *A Review of Approaches to Sharing and Relinquishing Agency-Assigned Spectrum*, at 50-51, IDA Paper P-5102 (Jan. 2014), available at <https://www.ida.org/upload/stpi/pdfs/p5102final.pdf>.

The FCC should update its spectrum screen and continue to use the screen in evaluating spectrum aggregation.

In 2003, the FCC moved from a spectrum aggregation cap to case-by-case review of proposed spectrum holdings that includes a spectrum screen and more in-depth analysis where warranted to address competitive issues. This case-by-case analysis has worked effectively for over 10 years to enable the FCC to evaluate the competitive impacts of secondary market transactions and auctions. Service providers of all sizes have successfully obtained spectrum at FCC auctions and through secondary market transactions, as demonstrated in a recent Mobile Future white paper.¹⁸ That 10-year track record reflects that the FCC's policies of full and open auction participation, moderated by a case-by-case review of spectrum aggregation, is effective to meet the spectrum needs of a diverse wireless marketplace – and, far more important – our nation's mobile innovators and consumers, who increasingly depend on its ongoing health and vibrancy.

- The Commission should continue to employ its case-by-case review framework, including its spectrum screen, with the following improvements:¹⁹ The framework should be predictable and transparent. The current uncertainty surrounding application of the spectrum screen, and delay in the review of secondary market transactions deters investment.
- The spectrum screen should be applied as originally intended – “to eliminate from further review those markets in which there is clearly no competitive harm relative to today's generally competitive marketplace - rather than to identify conclusively markets in which there *is* competitive harm.”²⁰ A flexible “safe harbor/case-by-case analysis” approach will provide additional certainty while still preserving additional FCC review in markets where the safe harbor is exceeded.
- The Commission should clearly articulate – particularly prior to each spectrum auction – what spectrum will be included in the screen to better enable auction participants to make reasoned bidding decisions. Uncertainty may inhibit auction participation, and deter or depress bids.

The FCC also should update the spectrum screen to reflect all spectrum suitable and available for mobile telephony/broadband. When adopting the screen, the Commission sought to ensure that its review was based on contemporary spectrum aggregation levels.²¹ It was not intended to be a static marker, frozen in time, but instead was envisioned as a dynamic

¹⁸ Mobile Future, *FCC Spectrum Auctions and Secondary Markets Policies: An Assessment of the Distribution of Spectrum Resources Under the Spectrum Screen* (Nov. 2013) (attached to Letter from Jonathan Spalter, Chair, Mobile Future, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 12-268 and WT Docket No. 12-269 (filed Nov. 13, 2013)).

¹⁹ Mobile Future submitted comments to the FCC in its Mobile Spectrum Holdings proceeding that address these issues in additional detail. See Comments of Mobile Future, WT Docket No. 12-269 (filed Nov. 28, 2012).

²⁰ See, e.g., *Applications of AT&T Wireless Services, Inc. and Cingular Wireless Corporation*, Memorandum Opinion and Order, 19 FCC Rcd 21522, 21568-69 ¶¶ 108-09 (2004) (“*AT&T/Cingular Order*”) (emphasis in original).

²¹ *AT&T/Cingular Order*, 19 FCC Rcd at 21568 ¶ 109 (noting that the Commission will subject to review any market “in which the level of spectrum aggregation will exceed what is present in the marketplace *today*” (emphasis added)).

benchmark that would evolve as technology advanced and regulators updated spectrum allocations to meet consumer demands. Indeed, the Commission has periodically recognized that such developments necessitate such updating.²² However, this infrequent updating has not kept pace with a continually evolving marketplace and spectrum policy changes.

Spectrum should be deemed “suitable” if it is capable of supporting mobile service, is licensed with a mobile allocation, and is not committed to another use that effectively precludes its use for the relevant mobile service.²³ Spectrum should be deemed “available” if it is “fairly certain that it will meet the criteria for suitable spectrum in the near term.”²⁴ Consistent with these definitions, at the very minimum, the Commission should update the screen to include the following:

- BRS/EBS: The current screen has included 55 MHz of Broadband Radio Service (“BRS”) and Educational Broadband Service (“EBS”) spectrum since 2008.²⁵ However, nearly all of that 188 megahertz of spectrum is suitable and available for mobile broadband services today – for example, Sprint uses this spectrum for networks that it says will cover 100 million people by the end of 2014,²⁶ and will be capable of providing peak data rates of approximately “150 [Mbps] to 180 [Mbps]” by the end of 2015.²⁷
- AWS-4 (40 megahertz): The Commission established service, technical, and licensing rules for this spectrum to permit terrestrial mobile use and has granted terrestrial authority to

²² For example, the screen was initially set at 70 MHz, which was approximately one-third of the 200 MHz that the Commission deemed available at that time for mobile telephony. See *AT&T/Cingular Order*, 19 FCC Rcd at 21568-69 ¶ 109; see also *Applications of Nextel Communications, Inc. and Sprint Corp.*, Memorandum Opinion and Order, 20 FCC Rcd 13967, 13994 ¶ 65 (2005). In 2007, four years after the screen took effect, the Commission included 80 MHz in the 698-806 MHz band (“700 MHz”), raising the screen to 95 MHz, approximately one-third of the amount of spectrum then deemed suitable for mobile telephony. *Applications of AT&T Inc. and Dobson Communications Corporation*, Memorandum Opinion and Order, 22 FCC Rcd 20295, 20312-13 ¶¶ 29-30 (2007). Most recently, the FCC included an additional 20 megahertz of WCS spectrum to the screen. *Applications of AT&T Mobility Spectrum, LLC, New Cingular Wireless PCS, LLC, Comcast Corporation, Horizon Wi-Comm, LLC, NextWave Wireless, Inc., and San Diego Gas & Electric Company*, Memorandum Opinion and Order, 27 FCC Rcd 16459, 16470-71 ¶ 31 (2012).

²³ *Policies Regarding Mobile Spectrum Holdings*, Notice of Proposed Rulemaking, 27 FCC Rcd 11710, 11722 ¶ 26 (2012) (“*NPRM*”) (Suitability is determined by “whether the spectrum is capable of supporting mobile service given its physical properties and the state of equipment technology, whether the spectrum is licensed with a mobile allocation and corresponding service rules, and whether the spectrum is committed to another use that effectively precludes its use for the relevant mobile service.”) (citing *Application of AT&T Inc. and Qualcomm Incorporated*, Order, 26 FCC Rcd 17589, 17605-06 ¶ 38 (2011) (“*AT&T/Qualcomm Order*”); *Applications of AT&T Inc. and Centennial Communications Corp.*, Memorandum Opinion and Order, 24 FCC Rcd 13915, 13935 ¶ 43 (2009); *Applications of Cellco Partnership d/b/a Verizon Wireless and Atlantis Holdings LLC*, Memorandum Opinion and Order and Declaratory Ruling, 23 FCC Rcd 17444, 17473 ¶ 53 (2008)).

²⁴ *NPRM*, 27 FCC Rcd at 11722 ¶ 26 (citing *AT&T/Qualcomm Order*, 26 FCC Rcd at 17606 ¶ 38).

²⁵ *Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993*, Fifteenth Report, 26 FCC Rcd 9664, 9824 ¶ 273 (2011) (“*Fifteenth Report*”); *Sprint Nextel Corporation and Clearwire Corporation*, Memorandum Opinion and Order, 23 FCC Rcd 17570, 17596 ¶ 61 (2008).

²⁶ Comments of Joseph Euteneuer, Sprint CFO, Deutsche Bank Media, Internet & Telecom Conference (Mar. 10, 2014).

²⁷ Comments of Dan Hesse, Sprint CEO, UBS Global Media and Communications Conference (Dec. 10, 2013). Hesse noted, “two years, it will be more like 150 megabits to 180 megabits per second because we have a 120 megahertz of spectrum on Clearwire and what we're able to do is rather than have a whole bunch of 20s, slap them basically into two big massive 60s megahertz that can go really, really fast, and that's leading-edge technology.” *Id.*

existing mobile satellite service licensees in the AWS-4 band.²⁸ The FCC has repeatedly recognized that terrestrial use of this spectrum will enhance competition and innovation in mobile broadband,²⁹ and has identified the spectrum as being available for mobile wireless services.³⁰

- H Block (10 megahertz): The Commission adopted service, technical, and licensing rules for this spectrum³¹ and recently completed an auction in which all 176 licenses offered were won.³²

In addition, since “available” spectrum includes spectrum that “will meet the criteria for suitable spectrum in the near term,”³³ spectrum should be included in the screen once the FCC has adopted service rules and the date for the FCC to license such spectrum has been announced. For spectrum that already is licensed, but with respect to which the FCC modifies its rules to enable the provision of mobile telephony/broadband, that spectrum should be included in the screen once the revised rules are adopted.

Finally, the Commission’s screen should not differentiate among different spectrum bands suitable for mobile telephony/broadband. As the FCC has recognized, different spectrum bands have unique propagation characteristics and deployment requirements, each with their own strengths and weaknesses depending on the circumstances and needs of various consumers and markets.³⁴ The propagation characteristics of lower band spectrum allow it to “provide superior coverage over larger geographic areas,” making it “ideal for delivering advanced wireless services to rural areas.”³⁵ But “higher-frequency spectrum may be just as effective, or more effective, for providing significant capacity, or increasing capacity, within smaller geographic areas.”³⁶ Indeed, the FCC noted that higher-band spectrum “can be ideally suited for providing high capacity where it is needed, such as in high-traffic urban areas.”³⁷ In sum, no particular band can be said to be always superior – or inferior – to others. Service providers determine what spectrum they need based on multiple factors including technical requirements and

²⁸ See *Service Rules for Advanced Wireless Services in the 2000-2020 MHz and 2180-2200 MHz Bands*, Report and Order and Order of Proposed Modification, 27 FCC Rcd 16102 (2012) (“AWS Order”).

²⁹ See *AWS Order*, 27 FCC Rcd at 16103 ¶ 1; see also FCC, *Connecting America: The National Broadband Plan*, at 87-88 (Mar. 2010); *Fixed and Mobile Services in the Mobile Satellite Service Bands at 1525-1559 MHz and 1626.5-1660.5 MHz, 1610-1626.5 MHz and 2483.5-2500 MHz, and 2000-2020 MHz and 2180-2200 MHz*, Notice of Proposed Rulemaking and Notice of Inquiry, 25 FCC Rcd 9481, 9490-91 ¶ 21 (2010); *Fixed and Mobile Services in the Mobile Satellite Service Bands at 1525-1559 MHz, 1626.5-1660.5 MHz, 1610-1626.5 MHz and 2483.5-2500 MHz, and 2000-2020 MHz and 2180-2200 MHz*, Report and Order, 26 FCC Rcd 5710, 5710 ¶ 1 (2011).

³⁰ See *Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993*, Sixteenth Report, 28 FCC Rcd 3700, 3777 ¶ 99 (2013).

³¹ *Service Rules for Advanced Wireless Services H Block – Implementing Section 6401 of the Middle Class Tax Relief and Job Creation Act of 2012 Related to the 1915-1920 and 1995-2000 MHz Bands*, Report and Order, 28 FCC Rcd 9483 (2013).

³² *Auction of H Block Licenses in the 1915-1920 MHz and 1995-2000 MHz Bands Closes; Winning Bidder Announced for Auction 96*, Public Notice, DA 14-279 (rel. Feb. 28, 2014).

³³ *AT&T/Qualcomm Order*, 26 FCC Rcd at 17606 ¶ 38, n.117.

³⁴ See *Fifteenth Report*, 26 FCC Rcd 9664.

³⁵ *Fifteenth Report*, 26 FCC Rcd at 9833 ¶ 292 (quoting *Service Rules for the 698-746, 747-762, and 777- 792 MHz Bands*, Second Report and Order, 22 FCC Rcd 15289, 15349 ¶ 158 (2007)).

³⁶ *Fifteenth Report*, 26 FCC Rcd at 9836 ¶ 296 (citation omitted).

³⁷ *Fifteenth Report*, 26 FCC Rcd at 9837 ¶ 296 (citation omitted).

consumer demand, and the Government should not substitute its judgment for the dynamics of the market, preferences of consumers and technological development by imposing an arbitrary distinction between the higher- and lower-band spectrum.

Unlicensed spectrum in higher spectrum bands is a valuable complement to licensed spectrum.

Unlicensed spectrum in higher bands, as a complement to licensed spectrum, plays an important role in meeting ever increasing consumer demand for broadband services. Unlicensed spectrum helps deliver speed and capacity to consumers by enabling the efficient offload of mobile traffic from congested, licensed spectrum onto less congested, unlicensed spectrum. Continued availability of unlicensed spectrum in higher bands – such as the recent FCC actions to make an additional 100 MHz of unlicensed spectrum available in the 5 GHz band – will continue to promote these results.

Lower band spectrum that is ideal for the provision of mobile broadband should continue to be made available on a licensed basis, to spark continued substantial investment in those bands. Indeed, the 2012 Spectrum Act requires the 600 MHz spectrum in the broadcast incentive auction to be offered on a licensed basis, and only allows the FCC to permit unlicensed operations in guard bands that are “no larger than is technically reasonable to prevent harmful interference between licensed services outside the guard bands.”³⁸ The FCC should follow that same approach when adopting service rules to govern future spectrum allocations.

Conclusion.

The Committee’s white paper aptly recognizes the critical role that spectrum policy plays in addressing consumer demand, enabling innovation and fostering investment. Mobile Future thanks the Committee for inviting feedback on the white paper and stands ready to provide the Committee additional feedback as it considers these important issues.

Respectfully submitted,

/s/ Jonathan Spalter

Jonathan Spalter, Chair

Allison Remsen, Executive Director

Rachael Bender, Policy Director

Mobile Future

1325 Pennsylvania Avenue, N.W., Suite 600
Washington, D.C. 20004


www.mobilefuture.org

³⁸ 2012 Spectrum Act § 6407(b) and (c).



April 25, 2014

Honorable Fred Upton
Chairman
Committee on Energy and Commerce
U.S. House of Representatives
2125 Rayburn House Office Building
Washington, D.C. 20515

Honorable Greg Walden
Chairman
Subcommittee on Communications and Technology
Committee on Energy and Commerce
U.S. House of Representatives
2125 Rayburn House Office Building
Washington, D.C. 20515

Dear Chairman Upton and Chairman Walden:

Motorola Mobility LLC (“Motorola Mobility”) appreciates the opportunity to comment on the Committee on Energy and Commerce (“Committee”) white paper regarding modernization of U.S. spectrum policy. As the Committee recognizes, spectrum is a fundamental resource to the wireless industry. Effective spectrum policy is key to realizing the economic, cultural, and consumer benefits of continued development of wireless broadband technology. As a result, it is a national imperative for policymakers to identify and implement spectrum policies that promote innovation and economic development. The Committee’s white paper is an important step in this process.

Motorola Mobility’s comments addresses three of the many important policy issues raised in the white paper: (1) the role, allocation, and management of unlicensed spectrum in the wireless ecosystem; (2) the development of spectrum sharing mechanisms to encourage efficient spectrum use; and (3) the regulation of receiver performance to combat increasing interference problems. These issues are central to ensuring the efficient and rational use of spectrum, and the satisfactory resolution of each is critical to the development of successful spectrum policies in the United States.

I. A BALANCED APPROACH TO SPECTRUM POLICY ACCOMMODATING BOTH LICENSED AND UNLICENSED SPECTRUM IS ESSENTIAL TO MEETING INCREASING CONSUMER DEMANDS FOR WIRELESS BROADBAND SERVICES.

Motorola Mobility supports a balanced approach to spectrum policy that accommodates both licensed and unlicensed spectrum use. While allocating additional licensed spectrum enables the provision of robust mobile broadband services, the availability of unlicensed



spectrum plays an important, complementary role. Because unlicensed spectrum offers lower barriers to entry, it promotes innovation by providing opportunities for entrepreneurs and other new market entrants.

There will always be a critical need for licensed spectrum. Commercial mobile radio services (“CMRS”) require a baseline level of certainty regarding capacity and quality of service that can best be delivered using licensed spectrum. Additional licensed spectrum, particularly low band spectrum, will play a key role in satisfying future data traffic demands in urban as well as rural areas. From a device perspective, the certainty and interference protection associated with exclusively licensed spectrum allows manufacturers to develop diverse consumer-oriented products that can do more, perform faster, and cover a greater area. Therefore, Congress, the Federal Communications Commission (“FCC”), and other Federal agencies must continue to work together to bring additional licensed spectrum resources to the market.

At the same time, however, unlicensed spectrum is an important counterpart. Unlicensed spectrum fostered the development of numerous technologies that have helped the industry use available spectrum more efficiently. Popular standards such as Bluetooth and Near Field Communication (“NFC”) rely on unlicensed spectrum. Manufacturers implement Bluetooth wireless technology into products as diverse as automobiles and medical devices, and Bluetooth-enabled devices are available worldwide. For example, more than 2.5 billion Bluetooth-enabled products were shipped in 2013.¹ And researchers estimate that by 2018 the installed base of Bluetooth-enabled devices will grow to almost 10 billion.² Perhaps most importantly, unlicensed spectrum led to the innovation of Wi-Fi. Wi-Fi technology has had a transformative effect on the way consumers transmit and receive data. Recent analysis has found that Wi-Fi traffic in the United States is growing by 68 percent per year, and that by 2017, 86 percent of U.S. homes will have Wi-Fi.³ By 2017, there will be over 7 billion Wi-Fi devices in use globally.⁴

Furthermore, as wireless demand continues to grow at an escalating pace, unlicensed spectrum increasingly will be crucial to reducing congestion and maintaining the quality of service that consumers have come to expect from devices that rely on licensed spectrum. As FCC Chairman Tom Wheeler remarked recently, “[u]nlicensed has been not only a key to innovation, not only a key to making wireless something manifest to consumers in their daily lives in a very

¹ Bluetooth SIG, “Our History,” <http://www.bluetooth.com/Pages/History-of-Bluetooth.aspx> (last visited April 25, 2014).

² Press Release, ABI Research, With an Installed Base of 10 Billion Devices Expected in 2018, Bluetooth will be an Essential Tool for Building the Internet of Everything (Aug. 6, 2013) *available at* <https://www.abiresearch.com/press/with-an-installed-base-of-10-billion-devices-expec>.

³ Raul Katz, Telecom Advisory Services LLC, Assessment of the Economic Value of Unlicensed Spectrum in the United States 4, February 2014, *available at* <http://www.wififorward.org/wp-content/uploads/2014/01/Value-of-Unlicensed-Spectrum-to-the-US-Economy-Full-Report.pdf>.

⁴ Press Release, Strategy Analytics, US Wi-Fi Households to Own Average of 11 Wi-Fi Devices in 2017 says Strategy Analytics (Feb. 27, 2014), *available at* <http://www.strategyanalytics.com/default.aspx?mod=pressreleaseviewer&a0=5483>.



easy way . . . but it has also been a great enabler of the licensed services and the ability to offload services from the licensed.”⁵ According to Cisco, 45 percent of the United States’ mobile data traffic was offloaded in 2013 – a figure that is estimated to grow to 52 percent of all traffic by 2018.⁶ Beyond just alleviating congestion, Wi-Fi offload has a significant economic impact: researchers estimate that Wi-Fi offloading generates a total economic surplus of \$12.602 billion and contributed \$3.102 billion to GDP in 2013.⁷

As more devices use unlicensed spectrum technologies to transmit and receive data, licensed networks will experience reduced congestion and customers will enjoy improved service quality, illustrating how licensed and unlicensed spectrum work effectively hand-in-hand. It is important to complement traditional licensed networks with those utilizing unlicensed spectrum, and future spectrum policies should continue to balance both licensed and unlicensed regulatory models to promote efficient spectrum use.

II. SPECTRUM SHARING IS AN IMPORTANT TOOL TO ENCOURAGE EFFICIENT SPECTRUM USE BY ALL USERS.

Motorola Mobility supports the development of spectrum sharing technologies as mechanisms to achieve more efficient and productive use of spectrum. Although exclusively licensed spectrum may be optimal for certain quality of service and commercial services, an increasingly congested spectrum environment renders some amount of spectrum sharing necessary and inevitable. Indeed, dynamic spectrum sharing has been a longstanding company endeavor; Motorola, Inc. pioneered the concept of mitigating interference through the use of a geolocation database. Such databases – as well as temporal sharing, geographic sharing, and other dynamic sharing technologies – are already utilized to improve spectrum efficiency and facilitate sharing. Perhaps most important, maximizing the use of spectrum that is currently unused or underused can help meet growing broadband demand. In this respect, spectrum sharing plays an important role in helping to achieve the Nation’s goals of providing quality broadband service to all Americans.

To facilitate the most seamless implementation of sharing technologies possible, the mobile wireless industry is committed to working with Federal users to identify the bands and mechanisms best suited for robust sharing. To that end, it will be increasingly important to introduce appropriate incentives for all parties, including industry and government spectrum users, to collaborate in creating a viable framework under which sharing can operate effectively and efficiently. A good example of such collaborative efforts is the FCC’s Further Notice of

⁵ Tom Wheeler, Chairman, Federal Communications Commission, Remarks at the LEARN Workshop to Discuss Unlicensed Spectrum Issues (Nov. 8, 2013) (video available at <http://www.fcc.gov/events/learn-workshop-discuss-unlicensed-spectrum-issues> (last visited Dec. 19, 2013)).

⁶ Press Release, Cisco, Cisco Visual Networking Index Forecast Projects Nearly 11-Fold Increase in Global Mobile Data Traffic from 2013 to 2018 (Feb. 5, 2014), available at <http://newsroom.cisco.com/press-release-content?type=webcontent&articleId=1340551>.

⁷ Katz, *supra* note 2, at 9.



Proposed Rulemaking in the 3.5 GHz proceeding that was released just this week.⁸ In the FNPRM, while the FCC proposed to adopt exclusion zones first proposed by NTIA in 2010, the FCC also stressed that those zones would serve only as a starting point, and that further dialogue is planned with NTIA to reassess the zones – a reassessment that will include industry input and analysis. Motorola Mobility applauds the FCC’s recognition that ongoing engagement with both federal and industry partners is crucial in evaluating and evolving the Nation’s spectrum policies.

III. GOVERNMENT REGULATION OF RECEIVER PERFORMANCE IS UNNECESSARY AND UNDESIREABLE.

Despite wireless industry standards developing organizations working for years on various technical measures to enhance the capabilities of all elements of the wireless systems, including receivers, some parties persist in calling for direct government regulation of receiver standards. There is no need for government regulation of receiver performance for devices operating in the wireless ecosystem, as stiff competition in the wireless industry makes the production of high-quality receivers a commercial necessity. Although growing demand for broadband capacity requires wireless systems to operate closer in frequency, space, and time, which leads to the increased potential for interference between devices, the industry is proactively addressing these challenges. In order to continue to meet customer expectations, receiver performance will continue to improve, without the need for top-down government regulation.

As the Committee recognizes, one way to address interference is through improved receiver performance. However, the wireless industry has led this effort, developing, on its own volition, technical standards governing all components of the mobile broadband platform, including specifications for both receiver and transmitter performance. These standards have allowed the industry to develop receivers that are extremely resistant to interference. The remarkable success of this system is evidenced by the relatively small number of interference situations requiring the FCC’s involvement, as the agency itself has recognized.⁹ And market forces ensure that the industry will continue to develop these types of solutions in the absence of additional regulatory processes, because the highly competitive U.S. wireless industry, which is at the forefront of developing robust receivers, drives manufacturers to adapt and innovate rapidly to meet consumer demand.

Indeed, increased regulation would serve only to slow down industry innovation and could be counter-productive. In contrast to regulations that may be technically obsolete as soon

⁸ See Amendment of the Commission’s Rules with Regard to Commercial Operations in the 3550-3650 MHz Band, *Further Notice of Proposed Rulemaking*, GN Docket No. 12-354, FCC 14-49 (rel. Apr. 23, 2014).

⁹ See Interference Limits Policy – The Use Of Harm Claim Thresholds To Improve The Interference Tolerance Of Wireless Systems at 17, White Paper, Receivers and Spectrum Working Group, FCC Technological Advisory Council, February 6, 2013 (“TAC White Paper”) available at <http://transition.fcc.gov/bureaus/oet/tac/tacdocs/WhitePaperTACInterferenceLimitsv1.0.pdf> (“Interference negotiations between parties in the same service (e.g., cellular) are common, and the FCC is rarely if ever called upon.”).



as they have been adopted, industry-driven processes allow manufacturers to react swiftly to evolving wireless technologies and changing customer demands. No need exists for top-down regulation, costly rulemaking proceedings, or additional testing and certification requirements when wireless industry members already are heavily incentivized by competition to develop measures to effectively address interference issues.

At bottom, any benefit from increased government regulation of receiver performance would be outweighed by the costs. Instead, interference issues are best addressed by allowing the industry to continue its consensus-based approach to receiver standards.

Sincerely,

/s/ Melissa Glidden Tye
Melissa Glidden Tye
Head of Federal Policy

Alexander Gerdenitsch
Radio Spectrum Engineer

Motorola Mobility LLC
1101 New York Ave., N.W.
Suite 210
Washington, D.C. 20005

cc: Hon. Henry A. Waxman, Ranking Member, Committee on Energy and Commerce
Hon. Anna Eshoo Ranking Member, Subcommittee on Communications and
Technology



RESOLUTION OF THE NATIONAL ASIAN PACIFIC AMERICAN CAUCUS OF STATE LEGISLATORS

Calling on the Federal Government to Make More Wireless Spectrum Available to Promote Economic Development, Increase Innovation in Education and Healthcare, and to Offer More Choices for Consumers

WHEREAS, the National Asian Pacific American Caucus of State Legislators (NAPACSL) consists of over 100 state elected officials with Asian or Pacific Islander ancestry;

WHEREAS, Asian Americans and Pacific Islanders are one of the fastest growing ethnic populations in the United States, having increased 43.3% from 2000 to 2010;

WHEREAS, 18.5 million Asian Americans and Pacific Islanders currently represent 5.6% of the U.S. population, and are projected to increase to 6.5% by the year 2020, and to 9.3% by 2050;

WHEREAS, NAPACSL recognizes the hopes, aspirations, and concerns of Asian Americans and Pacific Islanders, and works to advance these interests through public policy deliberations;

WHEREAS, extraordinary advances in information and communications technology have forever changed the way people interact with one another, and the wireless industry in particular has revolutionized society through new devices, services, and applications;

WHEREAS, the demand by Americans for wireless communications has surpassed its demand for wireline services as the latest fourth generation (4G) wireless technology can provide speeds that match wireline services;

WHEREAS, Internet data traffic through wireless mobility has skyrocketed more than 275% since 2010 and is expected to increase another 26-fold by 2015;

WHEREAS, American leadership in mobile communications is being challenged by global competition as more than 150 carriers in 60 countries are working to deploy 4G services and other countries are on track to exceed American wireless spectrum supply, while the future competitiveness of America's wireless industry depends on the availability of more spectrum within the United States;

WHEREAS, in June 2010, President Obama issued a Presidential Memorandum entitled, "Unleashing the Wireless Broadband Revolution," declaring that "the world is going wireless, and we must not fall behind," and that the resurgence of American productivity growth largely reflects investments by American companies, the public sector, and citizens in the new communications technologies that created the Internet;

WHEREAS, the 2010 Presidential Memorandum acknowledges that expanded wireless broadband access will trigger the creation of innovative new businesses, provide cost-effective connections in rural areas, increase productivity, improve public safety, and allow for the development of mobile telemedicine, telework, distance learning, and other new applications that will transform Americans' lives;

WHEREAS, the 2010 Presidential Memorandum warns that this new era in global technology leadership will only happen if there is adequate spectrum available to support the forthcoming myriad of wireless devices, networks, and applications that can drive the new economy;

WHEREAS, the 2010 Presidential Memorandum charges the National Telecommunications and Information Administration, Federal Communications Commission (FCC) and other federal government agencies to develop a plan for making available 500 MHz of additional spectrum over the next 10 years;

WHEREAS, in his 2011 State of the Union address, President Obama announced his "Wireless Innovation and Infrastructure Initiative," setting the goal of enabling businesses to provide high-speed wireless services to at least 98 percent of all Americans within five years by freeing up 500 MHz of additional spectrum by using voluntary incentive auctions and more efficient use of government spectrum;

WHEREAS, in February 2012, the Obama Administration issued a report entitled, "The Economic Benefits of New Spectrum for Wireless Broadband," finding that the amount of wireless spectrum currently allocated to the private sector is insufficient to handle the projected growth in demand, even with technological improvements allowing for more efficient use of existing spectrum and significant investment in new facilities;

WHEREAS, the 2012 Obama Administration report concludes that the only feasible way to realize the full potential of wireless broadband is to make more new spectrum available for wireless services;

WHEREAS, in 2012, Congress passed the Middle Class Tax Relief and Job Creation Act of 2012 which included the Spectrum Act, authorizing the FCC to conduct incentive auctions of spectrum originally held by broadcast television industry to be repurposed for new commercial wireless communications needs, and the FCC is working on its implementation;

WHEREAS, in June 2012, the FCC Chairman appointed the mHealth Task Force, consisting of a group of the nation's leading wireless healthcare technology experts from industry, government, and academia to assess the opportunities and challenges facing the adoption of wireless health technologies;

WHEREAS, after conducting extensive research and stakeholder outreach, the FCC mHealth Task Force recommended that the FCC should make more licensed mobile spectrum available to ensure reliable connectivity for spectrum-intensive healthcare services such, as live video, remote monitoring, radiological imaging, and other medical applications;

WHEREAS, in June 2013, President Obama announced his "ConnectED Initiative," challenging the FCC to connect 99% of America's students through next-generation broadband to, and high-speed wireless within, their schools and libraries with broadband speeds of no less than 100 Mbps and with a target of 1 Gbps;

WHEREAS, the ConnectED Initiative urges the private sector to innovate with educational devices supported by high-speed networks to expand the world of online learning and interactive content, create personalized education software that adapts to students' needs, and develop other breakthrough advances in assessing students' understanding and mastery of subjects;

WHEREAS, cutting-edge wireless devices that could replace printed textbooks, educational software that incorporates rich visualizations of complex concepts and foreign languages, and other digital learning technologies that create rigorous and engaging classes are all heavily dependent on the scarce spectrum currently available on school campuses;

WHEREAS, in June 2013, President Obama issued a second Presidential Memorandum entitled, "Expanding America's Leadership in Wireless Innovation," urging more spectrum be made available as promptly as possible for the benefit of consumers and businesses, while, at the same time, ensuring that federal, state, local, tribal, and territorial governments are able to maintain mission critical capabilities that depend on spectrum today and efficiently meet future requirements;

WHEREAS, the wireless industry's contributions to the economy have grown five times faster than the rest of the economy over the last decade and these investments support IT-intensive sectors such as education, healthcare, and energy;

WHEREAS, the broadband industry has invested nearly \$1.2 trillion dollars since 1996, and in 2012 alone, the American wireless carriers made \$30.1 billion in incremental capital investment, which averages about \$94 of private sector investment per subscriber;

WHEREAS, every \$1 invested in wireless broadband innovations generates an additional \$7 to 10 in national GDP, and, on average, wireless industry jobs pay 50% more than the national average of other production workers;

WHEREAS, America's wireless industry is ready to expand and improve the 4G networks by make significant investments of up to \$53 billion over the next four years, which could account for \$73 to \$151 billion in GDP growth and 371,000 to 771,000 new jobs;

WHEREAS, the "mobile app" economy has already created 466,000 American jobs since the iPhone was first introduced in 2007, and, as of September 2012, there are over 28 independent non-carrier app stores, offering over 2.7 million apps for eleven different operating systems;

WHEREAS, NAPACSL understands that 48% of Asian Americans and Pacific Islanders own and use mobile smartphones, which is a higher rate than any other ethnic or general population group in the U.S.;

WHEREAS, 87% of Asian Americans and Pacific Islanders enjoy access to the Internet, which is also a higher rate than any other ethnic or general population group, and Asian Americans and Pacific Islanders spend about three and a half times more time online than other groups;

WHEREAS, NAPACSL recognizes that the spectrum crunch in wireless demand could negatively impact Asian Americans and Pacific Islanders as consumers, workers and entrepreneurs disproportionately than it would impact other population groups;

THEREFORE, BE IT RESOLVED, that the National Asian Pacific American Caucus of State Legislators applauds President Obama's Wireless Innovation and Infrastructure Initiative, which calls for nearly doubling the amount of spectrum available for wireless broadband in the next ten years, by freeing up 500 MHz of spectrum currently allocated for other uses;

BE IT FURTHER RESOLVED, that NAPACSL calls upon the federal government to hasten its efforts to implement the President's goals of identifying and repurposing for commercial use spectrum currently used by government agencies as rapidly as possible;

BE IT FURTHER RESOLVED, that NAPACSL applauds Congress for passing the Spectrum Act to repurpose spectrum held by the broadcast industry to be used for wireless broadband;

BE IT FURTHER RESOLVED, that NAPACSL calls upon the FCC to quickly implement incentive auctions in response to the Spectrum Act and allow all bidders to participate so that the government can raise the most revenues and the private sector investments can continue to make advancements in mobile technology and create jobs;

BE IT FURTHER RESOLVED, that NAPACSL calls upon the federal government to develop policies and procedures to promote vibrant and healthy secondary markets that allow private sector institutions the flexibility to enter into agreements that make the best use of all spectrum assets; and

BE IT FINALLY RESOLVED, that a copy of this resolution be transmitted to the President of the United States, Members of Congress, and the Federal Communications Commission.

SPONSORED BY: Representative Ken Ito, Hawaii

COMMITTEE: Economic Development Committee

ADOPTED ON AUGUST 13, 2013, AT ANNUAL MEETING IN ATLANTA, GEORGIA

CERTIFIED BY: Representative Sharon Tomiko Santos, Washington, NAPACSL Chair



4400 Jenifer St NW Suite 331 Washington, DC 20015

202-466-6888 Fax 202-466-4918

www.nationalbcc.org info@nationalbcc.org

NBCC comments to the House Energy and Commerce Committee about the upcoming rewrite of the Telecom Act

April 25, 2014

Dear Chairmen Upton and Walden and Ranking Members Waxman and Eshoo,
We are writing to applaud you for undertaking the bipartisan process of updating the laws and regulations that govern our country's communications marketplace.

For too long, these laws have been overtaken by technological and marketplace change and for too long they have not fostered the best environment for our consumers, small businesses and most importantly, people of color.

The constituents of the NBCC – small businesses in African American communities – benefit greatly from our communications landscape. Government policies that encouraged the availability of broadband and its adoption have had a profound effect on the economic health and availability of jobs within minority communities throughout the United States.

Broadband enables countless opportunities that benefit African-American small businesses which, according to the U.S. census, are growing at the rate of 45% - one of the highest and fastest growing segments of the U.S. economy. To continue that progress, we need Congress to move forward with updating our communications laws.

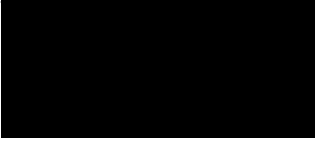
As you look to update our laws, it is important to remember that simpler is usually better and that overly-complex new laws tend to hurt small businesses the most. That is why the NBCC supports simple principles for the future law, that:

- Provides the same opportunities for innovation and growth in the Internet economy regardless of technology or platform
- make sure there is a clear and documented harm to customers that cannot be fixed by the market before the government intervenes; and
- preempt state and local municipalities from imposing barriers or patchwork laws and regulations that place heavy burdens on minority owned small businesses

With these simple principles, we can move our communications laws forward and help speed the innovation and certainty needed for minority small business owners to bring their products and

services to market. Establishing a clear bipartisan approach to move this legislation is paramount and NBCC will help build consensus across any political and ideological divisions. Updating our country's communications laws are too important to our small businesses to get stuck in a Washington morass and we urge all of you to move forward with this update in a timely manner.

Sincerely,



Harry C. Alford
President/CEO

Modernizing Spectrum Policy
Questions from the House Committee on Energy and Commerce

Responses of the National Cable & Telecommunications Association

Question 1: “As discussed in white paper #1 on Modernizing the Communications Act, the telecommunications industry has experienced a great deal of convergence in recent years. One result is that the current licensing structure at the FCC may no longer be the most efficient or appropriate method to maximize spectrum use. The FCC is responsible for licensing spectrum for a number of services, including public safety, fixed and mobile wireless, broadcast television and radio, and satellite. Although many of the processes are the same among these services, the licensing authority is housed in disparate bureaus. What structural changes, if any, should be made to the FCC to promote efficiency and predictability in spectrum licensing?”

Response 1: NCTA does not have a position on the specific question of structural changes in the FCC licensing organization. NCTA agrees, however that Congress and the FCC should focus on the trend of convergence as they make both licensed and unlicensed spectrum policy. To account for convergence and to promote innovation, we suggest that Congress and the FCC avoid laws or rules that mandate specific technical approaches or standards.

Question 2: “Spectrum users are allowed to operate without an FCC license—subject to certain technical rules—in spectrum that is designated as ‘unlicensed.’ In 1985, the FCC opened up frequency bands, including the 2.4 GHz band, for unlicensed communications, and has since allocated other bands specifically for unlicensed operators. Users of unlicensed spectrum do not have exclusive use rights and are subject to interference by others. While operators do not need a license, they must abide by other regulatory safeguards, including authorization of equipment, accepting any interference and not causing harmful interference to others, and ceasing operations upon FCC notification. There is vigorous debate over the appropriate role for unlicensed spectrum in the wireless ecosystem, particularly following the passage of the Spectrum Act. The Act requires the FCC to auction all spectrum made available by the incentive auction, but allows for unlicensed use in guard bands. Some contend that there is an ample amount of unlicensed spectrum available and that assigning spectrum via exclusive licensing is the most effective, efficient, and economically responsible way to allocate spectrum. Others argue that repurposed spectrum should be allocated for unlicensed use for similar reasons. What role should unlicensed spectrum play in the wireless ecosystem? How should unlicensed spectrum be allocated and managed for long-term sustainability and flexibility?”

Response 2: Unlicensed wireless technologies are central to U.S. growth and innovation. Recent studies demonstrate that the annual contribution of the unlicensed wireless sector to the U.S. economy is more than \$200 billion. Unlicensed spectrum powers the widest diversity of applications of any use of spectrum – including home Wi-Fi networks, large outdoor Wi-Fi networks like CableWiFi, communications and automation systems used

by businesses, short-range connectivity through Bluetooth and ZigBee, RF identification systems, and educational networks in schools and libraries, with more applications emerging each year. The use of unlicensed technologies is growing faster than either wireline or licensed wireless technology. Soon, unlicensed traffic will surpass all other modes of communications as the final link to consumers. Unlicensed wireless networks already carry far more data than licensed wireless networks, and, in fact, strongly support licensed networks through offload. But unlicensed spectrum resources have not grown with consumer demand. Congress and the FCC should therefore pursue a balanced spectrum policy and consider ways to increase both licensed and unlicensed spectrum wherever possible. The following should all be a core part of a balanced U.S. spectrum policy: (1) creating new designations for unlicensed spectrum wherever possible, (2) protecting existing unlicensed designations, and (3) adopting pro-growth technical rules for unlicensed bands that continue to protect incumbent licensees from harmful interference.

Question 3: “Spectrum sharing is one proposed technological solution that addresses the issue of spectrum scarcity and encourages efficiency. There are multiple ways to share spectrum, including geographic sharing, temporal sharing, and sharing through dynamic spectrum access. In July 2012, the President’s Council of Advisors on Science and Technology (PCAST) issued a report on ways to realize the full potential of government held spectrum. The report concluded that sharing is the most efficient way to utilize spectrum and directed the Secretary of Commerce to immediately identify 1,000 MHz of federal spectrum for shared use. However, others assert that spectrum sharing is only part of the solution to spectrum scarcity and that clearing unused or underused federal for exclusive commercial use is a vital part of any strategy for maximizing spectrum resources. In order to enable this sort of reallocation, bipartisan legislation has been introduced in the House that would allow government spectrum users an option to relinquish spectrum and receive a portion of net auction revenues instead of relocation costs, a structure similar to that of the broadcast television spectrum incentive auctions. What should be done to encourage efficient use of spectrum by government users?”

Response 3: Government use of spectrum resources is critical to a wide range of national interests. National spectrum policy should recognize the importance of reliable government agency access to spectrum resources. At the same time, Congress, the FCC, and NTIA should work to identify instances where private use of a band would be more efficient and government users can move without undermining government needs – or, where this is not possible, where government and private users can share a band. The first step in this exploration is a better mechanism for sharing information between public and private spectrum users. Government agencies work hard to engage with private entities, but there is not a mechanism that allows the exchange of technical data and ideas in a reasonable timeframe while protecting sensitive information. Congress could promote sharing by creating such a mechanism.

Question 4: “Given the enormous economic benefits of innovation spurred by commercial spectrum availability, both the government and the private sector are concerned with making more spectrum available to meet commercial demand. When

discussing available resources, the FCC considers spectrum to be ‘currently available’ if providers have the legal authority to build out and provide services using that band, or ‘in the pipeline’ if it is not currently available for commercial services but there are government plans to make it available to commercial providers within the next three years. Congress and the FCC have worked to increase the amount of spectrum available to commercial providers, including through the provisions for auctions and relocation in the Middle Class Tax Relief and Job Creation Act. What other steps can be taken to increase the amount of commercially available spectrum?”

Response 4: Congress, NTIA, and the FCC can increase the amount of commercially available spectrum by designating bands for unlicensed use where higher-power licensed use is not possible or where licensed operations entitled to interference protection are otherwise infeasible. Unlicensed technologies can fill in temporal or geographic gaps where incumbents do not operate, can operate at lower power (and therefore share more effectively) than most licensed technologies deployed today, and can more easily share a band with an incumbent that uses a band lightly but cannot move (as is the case in the 5 GHz U-NII-1 and U-NII-4 bands, for example). Leaving these bands underutilized by incumbents would allow inefficiencies to persist and result in underutilization of U.S. spectrum resources.

Question 5: “In order to issue spectrum licenses, the Communications Act requires the FCC to make an affirmative finding that granting the license serves the public interest, convenience, and necessity. Moreover, the Act prohibits the FCC from basing its finding on the expectation of auction revenues. Should the Act permit the FCC to use expected auction revenue as the basis for a public interest finding? What criteria should the FCC consider as part of its analysis?”

Response 5: Congress should preserve the prohibition on basing a public interest finding on expected auction revenue. The goal of federal spectrum policy should be to serve the public interest by maximizing the total utility of the spectrum resource. It should not be to increase government revenues from auctions. Auctioning is frequently the best mechanism for maximizing total utility, but this is not always the case. Under existing law, the FCC can choose an auction mechanism in order to increase utility, but should not do so for the government-focused reason of increasing revenues if a non-auction approach maximizes utility.

Question 6: “The FCC’s existing process manages spectrum use through allocation and assignment — bands are allocated for specific services or classes of users, and licenses for use of specific portions of spectrum are assigned to entities. Many of the existing allocations were made because certain spectrum bands are better suited for certain uses. However, changes in technology have changed assumptions over the years. While restrictions have eased in recent years, there are still certain limited-use spectrum licenses. Flexible use licenses permit licensees to use their spectrum for any service, including wireless, broadcast, or satellite services. Should all FCC licenses be flexible use? In what instances should the Commission exercise control over the service offered? How can the Act enable better use of spectrum, either flexible or specified?”

Response 6: NCTA does not have a position on whether all licenses must be fully flexible.

Question 7: “Finite supply and ever increasing demand have created the scarcity around which the FCC’s regulatory controls are based. The FCC has placed limitations on spectrum holdings in a number of ways. In mobile wireless, the Commission has implemented policies that included the cellular cross-interest rule, the Personal Communications Service (PCS) cross-ownership rule, and the Commercial Mobile Radio Services spectrum cap. Currently, the Commission conducts a case-by-case analysis of spectrum aggregation for each entity. The two-part “spectrum screen” first analyzes changes in market concentration that would result from the proposed transaction, and then examines the amount of spectrum that is suitable and available on a market-by-market basis. Prompted by the passage of the Middle Class Tax Relief and Job Creation Act, the FCC initiated a proceeding to review existing policies regarding mobile spectrum holdings to determine whether they still satisfy the statutory goals of promoting competition and avoiding excessive concentration of licenses, given changes in technology, spectrum availability, and the overall marketplace. The FCC has considered other tools to try and enhance competition within the wireless services market. Among these are spectrum “set-asides,” where blocks of spectrum are reserved for a particular type of bidder; bidding credits, which provide a discount on winning bids to small businesses or to specific groups like women and minorities to encourage bidding; and auction design, including reserve prices, package bidding, and proposed restrictions on bidder eligibility. Given the complexity of spectrum auctions, these policies have been criticized for altering the playing field and distorting outcomes. What principles should Congress and the FCC consider when addressing spectrum aggregation limits? How has the converging marketplace and growing demand for services changed the discussion of spectrum aggregation?”

Response 7: NCTA does not have a position on this issue.

Question 8: “The FCC further promotes efficient use of spectrum through the build-out requirements and operating rules attached to licenses. Build-out rules require licensees to construct and activate infrastructure within a certain timeframe, or risk losing that license. The operating rules require some licensees to return a license if not used for any 12-month period after construction, promoting the active and continual use of spectrum. These provisions help to ensure that spectrum that is not fully utilized becomes available to those who will put it to dynamic use. Should the Act promote competitive and efficient use of spectrum in this way? How effective is the current Act in doing so? How effectively has the FCC used the tools at its disposal to encourage competition?”

Response 8: A great benefit of unlicensed designations is that they do not require a build-out requirement to incentivize high utilization. Because no one party controls access to the band, only those parties that invest can benefit from the band. NCTA sees value, however, in build-out rules for licensed bands that grant one party the exclusive use of the band. Such rules are particularly important for licensees that did not acquire spectrum rights through auction. Paying for rights through an auction provides a

substantial incentive to use a spectrum resource efficiently. To do otherwise could strand investment. But licensees that won a spectrum right through a government grant have less incentive to use the resource efficiently. In these cases, Congress and the FCC should either require a licensee to fully exploit a band within a reasonable period of time, or should grant unlicensed technologies the right to share the underutilized band with the incumbent.

Question 9: “As discussed above, interference can pose a major problem to efficient and full use of spectrum by providers. The FCC sets limits on transmissions, but doesn’t regulate the receivers used by wireless devices to receive wanted signals and eliminate the noise coming from the other surrounding spectrum bands. Underperforming receivers can prevent a device from operating properly. While the FCC has used tools like guard bands to mitigate the potential for interference, recent examples of receiver overload have shown that these efforts may not be enough as demand for spectrum increases but resources become more and more constrained. Some have proposed receiver standards as a solution, but others argue that such a step could result in over-engineering and higher consumer prices. What is the best balance between mitigating interference concerns and avoiding limiting flexibility in the future? Can engineering and forward-looking spectrum strategies account for the possibility of unanticipated technologies and uses in adjacent spectrum bands? How do we promote flexibility without unreasonably increasing the cost of services and devices? Does the Act provide the FCC tools to address this problem?”

Response 9: NCTA recommends that Congress and the FCC treat radios as systems when designing and enforcing interference rules. Each radio system contains both transmitters and receivers (either intended or unintended receivers). Regulating only one side of the system through command-and-control transmission rules will not promote efficiency. Adding command-and-control receiver regulations is not, however, the solution – doing so would limit innovation, and the FCC is not well-equipped to design receivers for a wide range of existing and future wireless technologies. The recent suggestion by the FCC Technological Advisory Council of adopting harm claim thresholds, however, is worth exploring. This approach would recognize the need to consider both transmitter and receiver characteristics in radio system design decisions by requiring interfering signals to exceed certain limits before the radio system can assert protection from harmful interference. But it would not impose command-and-control equipment rules, thereby maintaining flexibility for equipment manufacturers and network operators.

Question 10: “The other governing body of domestic spectrum use is the National Telecommunications and Information Administration (NTIA), which has the authority to assign spectrum frequencies to all federal government owned or operated radio stations under section 305 of the Communications Act. NTIA manages the federal government’s use of spectrum, in coordination with the FCC. Distinctions between “federal” or “non-federal” bands of spectrum are administrative creations made through agreements between the FCC and NTIA. The Spectrum Act required NTIA to work with the FCC to identify specific bands for release to commercial use and how to repurpose resources

from federal to commercial use, with priority given to options that assign spectrum for exclusive, non-federal use through competitive bidding. In a report on reducing duplication in the federal government, GAO identified spectrum management as ‘fragmented’ between NTIA and the FCC and urged coordination. What role should NTIA play in the licensing and management of spectrum? Is their current role appropriate and necessary, given the potentially duplicative functions of the FCC and NTIA in spectrum allocation and assignment?”

Response 10: NCTA does not have a position on these questions.



Dear Chairmen Upton, Walden, and Ranking Members Waxman and Eshoo:

The National Caucus and Center on Black Aged (NCBA) is a not-for-profit organization dedicated to preserving the dignity and enhancing the lives of low income elderly African Americans. As one of the largest minority focused organizations in the United States, NCBA addresses the needs of its constituency in the areas of health, affordable housing and employment. Founded in 1970 to ensure that the particular concerns of elderly minorities would be included during the 1971 White House Conference on Aging, NCBA works to facilitate the sharing of resources, information and experience across a variety of policy makers, legislators, advocacy and service organizations to address the issues that impact the quality of life for America's elderly minority population.

Through significant investment, innovation and expansion of technologies, the Internet has become an irreplaceable tool in the everyday lives of the elderly. From the dissemination of health education and community health promotion campaigns, to resource materials and training assistance, to employment opportunities, the Internet has aided greatly in expanding the abilities of the NCBA in providing for its member constituents. Without it, our reach and overall impact would be diminished drastically.

The advent of wireless technologies has proved to be a force multiplier in our outreach efforts. An April 2012 study by the Pew Research Center shows, after several years of minimal growth, 53% of American elderly aged 65 or older use the internet or email. Furthermore, of these elderly using the internet, 70% use the internet on a typical day highlighting the point that once adopted, this demographic becomes a voracious user of this technology. In addition to this, the study shows that 69% of adults aged 65 or older own a mobile phone – a significant increase from 57% in May 2010. Through cheaper access than legacy services, such as landline phones, to serving as an additional access point to the web, wireless technologies have proven to be invaluable to those that we represent. We have realized over the past few years that we are only beginning to see the potential of this technology, as mobile health and other wireless services are beginning to flourish.

As the trends of growth for this demographic continue, so should efforts to ensure continued access. The looming "spectrum crunch" is real for all Americans, and the elderly stand to be significantly impacted by this, especially in the most populous urban cities. Due to this threat, the Commission should thoroughly exhaust all measures to ensure that the

future of mobile networks can support the increasing demand, with one such way being to successfully execute the upcoming spectrum incentive auction.

We believe that the auction should be handled in an open and fair manner, so that those willing to invest in this technology have the ability to, and in turn continue the unprecedented innovation seen in this sector. The Commission has always and rightfully so placed as the cornerstone of their objective, to increase competition, innovation, and through these auctions, revenue for the federal budget.

The National Caucus and Center on Black Aged truly appreciates the thoughtful and diligent hard-work the Commission has done in this space, and looks forward to continue seeing the great advancements enabled through this body.

Sincerely,

A solid black rectangular box used to redact a signature.

President & CEO



NATIONAL CONGRESS OF AMERICAN INDIANS

April 25, 2014

The Honorable Fred Upton
Chair
Committee on Energy and Commerce
U.S. House of Representatives
2125 Rayburn House Office Building
Washington, DC 20515

The Honorable Marsha Blackburn
Vice Chair
Committee on Energy and Commerce
U.S. House of Representatives
2125 Rayburn House Office Building
Washington, DC 20515

The Honorable Greg Walden
Chair
Subcommittee on Communications
& Technology
U.S. House of Representatives
2125 Rayburn House Office Building
Washington, DC 20515

The Honorable Anna Eshoo
Ranking Member
Subcommittee on Communications
& Technology
U.S. House of Representatives
2125 Rayburn House Office Building
Washington, DC 20515

RE: PROPOSALS TO MODERNIZE U.S. LAWS GOVERNING SPECTRUM ALLOCATION, REGULATION, AND LICENSING

Dear Chairman Upton, Vice Chairwoman Blackburn, Chairman Walden, and
Ranking Member Eshoo:

On behalf of the National Congress of American Indians (NCAI), I respectfully submit these comments for the record in the matter of *Updating the Communications Act: White Paper Focused on Spectrum Policy*. Established in 1944, NCAI exists as the largest and oldest representative organization of American Indian and Alaska Native tribal governments. NCAI represents the broad interests of tribes and their citizens to advance, and promote the advancement of tribal sovereignty and self-determination. We are pleased to have this opportunity to provide vital input on how increased access to spectrum licenses could support tribal governments and tribal telecommunications providers.

As tribal nations become increasingly aware of the benefits broadband technologies and services offer, it is essential that certain barriers to entry are resolved to include our participation in this Digital Age. NCAI has developed a long-standing relationship with the Federal Communications Commission (FCC) and has continually participated in vital discussions to bridge the "Digital Divide" on tribal lands. One of our first steps to institutionalize a conduit for tribal leaders and technical experts to develop tribal telecommunications policies was through our establishment of the NCAI Telecommunications Subcommittee in 2001.

Since then, through resolutions adopted by our tribal nation membership, NCAI has advocated on issues such as tribal telecommunications consultation; Universal Service Fund reforms and modernizations; spectrum allocation and regulation; broadcast and media services; public safety communications; and Net Neutrality.

EXECUTIVE COMMITTEE

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SOUTHERN PLAINS
Stephen Smith
Kiowa Tribe

SOUTHWEST
Manuel Heart
Ute Mountain Ute Tribe

WESTERN
Arian Melendez
Reno Sparks Indian Colony

EXECUTIVE DIRECTOR
Jacqueline Johnson Pata
Tlingit

NCAI HEADQUARTERS
1516 P Street, N.W.
Washington, DC 20005
202.466.7767
202.466.7797 fax
www.ncai.org

CURRENT STATE OF TRIBAL TELECOMMUNICATIONS COMPANIES

Of the 566 federally recognized tribes in the United States, there are ten tribally-owned and operated telecommunications providers designated by the FCC as eligible telecommunications carriers (ETCs) – eligible to receive financial support from the Universal Service Fund. These tribal providers include:¹

- Cheyenne River Sioux Tribe Telephone Authority
- Fort Mojave Telecommunications, Inc.
- Gila River Telecommunications, Inc.
- Hopi Telecommunications, Inc.
- Mescalero Apache Telecommunications, Inc.
- Saddleback Communications (Salt River Pima-Maricopa Indian Community)
- San Carlos Apache Telecommunications, Inc.
- Standing Rock Telecommunications, Inc.
- Tohono O’odham Utility Authority
- Warm Springs Telecommunications Company

Many of these tribal telecommunications providers were established out of necessity by their respective tribal governments due to tribal lands being constantly overlooked by surrounding providers. While many were created to provide basic landline telephone service, and are now upgrading networks to support broadband, Standing Rock Telecommunications, Inc. (SRTI) operates as the only tribally-owned and operated commercial mobile service provider.

MODERNIZATION OF SPECTRUM POLICY TO SUPPORT TRIBAL SELF-DETERMINATION

While the last major update of the 1934 Communications Act occurred in 1996, the law contains no explicit references to tribes and how communications services are to be regulated on tribal lands. To ensure tribal inclusion in all matters before the FCC, the agency adopted a 2000 *Statement of Policy on Establishing a Government-to-Government Relationship with Indian Tribes*.² The FCC stated:

Since the passage of the Telecommunications Act of 1996, the Federal Communications Commission has made particular efforts to ensure that all Americans, in all regions of the United States, have the opportunity to access telecommunications and information services. Notwithstanding such efforts to promote ubiquitous service, the Commission has recognized that certain communities, particularly Indian reservations and Tribal lands, remain underserved, with some areas having no service at all.³

¹ See Federal Communications Commission. “Federal Communications Commission Office of Native Affairs and Policy: 2012 Annual Report”. Pg. 50. Released March 25, 2013. Available at <http://www.fcc.gov/document/office-native-affairs-and-policy-2012-annual-report>.

² See Federal Communications Commission. *In the Matter of: Statement of Policy on Establishing a Government-to-Government Relationship with Indian Tribes*. FCC 00-207. Released June 23, 2000. Available at http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-00-207A1.pdf.

³ *Id.*

Following the adoption of this policy and through the combined efforts of tribal governments and organizations like NCAI, the FCC held a series of regional training workshops in the early 2000's known as the "Indian Telecommunications Initiatives" (ITI). These ITI workshops provided technical assistance and training to tribes regarding assistance offered through the Universal Service Fund (USF). While these regional trainings provided much needed technical assistance, it was not until the FCC created its Office of Native Affairs and Policy (FCC-ONAP) in 2010 that tribes became increasingly included in proposed regulations considered at the FCC.

One March 3, 2011, the FCC announced a Notice of Proposed Rulemaking (NPRM): WT 11-40, in the Matter of *Improving Communications Services for Native Nations by Promoting Greater Utilization of Spectrum over Tribal Lands* (WT 11-40).⁴ This was one of the first tribal specific dockets released after the creation of FCC-ONAP, and a major step in further recognizing barriers and exclusions for tribal nations to access spectrum licenses. The initial comment period for this NPRM was set for May 19, 2011, with reply comments due on June 20, 2011.⁵ Since May 2011, there have been numerous filings by tribal entities that expressed a resounding need to increase tribal nation access to spectrum licenses (*see* Endnote¹). However, since the FCC announced WT 11-40, there has been no action to initiate a next phase of rulemaking. Spectrum access continues to elude tribal nations and has precluded tribal participation in the FCC's recent Mobility Fund and Tribal Mobility Fund auctions.

For instance, of the 52 participating bidders in the \$300 million Mobility Fund Phase 1 auction, only three were tribally-owned and operated telecommunications providers; and of those three, only one was selected as a winning bidder. That winning bidder was SRTI, the first tribally-owned and operated ETC wireless service provider. SRTI holds a license to spectrum that they acquired through a 'secondary market transaction', which many tribes have been unable to accomplish with incumbent license holders over tribal lands. The other two tribal carriers who bid but were not selected as winning bidders, cited issues with the lack of access to the spectrum licenses needed to serve areas of their tribal lands eligible for Mobility Fund Phase 1 support. As the Mobility Fund and Tribal Mobility Fund auctions occur over the next decade, the lack of access to spectrum will become an even greater barrier to tribal participation. The FCC's focus on wireless deployment throughout the country will only further increase the Digital Divide in Indian Country.

Any updates to the Telecommunications Act of 1996 must include tribal specific language to increase access to spectrum, especially those tribal areas current license holders refuse to serve. The focus of these comments will highlight certain tribal specific proposals the FCC announced in Docket No. WT 11-40. These proposals should be included in any update of the 1996 Telecommunications Act to ensure tribal parity in the telecommunications sector.

⁴ See Federal Communications Commission. *In the Matter of Improving Communications Services for Native Nations by Promoting Greater Utilization of Spectrum Over Tribal Lands*. Notice of Proposed Rulemaking. WT Docket No. 11-40. Available at <http://apps.fcc.gov/ecfs/comment/view?id=6016822908>.

⁵ See Federal Register Notice. Federal Communications Commission, 47 CFR Part 1, [WT Docket No. 11-40; FCC 11-29]. Federal Register Volume 76, Number 64. Published Monday, April 4, 2011. Accessed January 14, 2013. Available at <http://www.gpo.gov/fdsys/pkg/FR-2011-04-04/html/2011-7825.htm>.

TRIBAL SPECIFIC PROPOSALS INCLUDED IN FCC DOCKET NO. WT 11-40

I. PROPOSING A ‘TRIBAL PRIORITY’ TO COMMERCIAL WIRELESS SPECTRUM

When the FCC released WT 11-40, the agency recognized proposals from the *National Broadband Plan (NBP)* to extend a tribal licensing priority to commercial wireless spectrum. Recommendations from the *NBP* called for developing re-licensing rules for unused spectrum to tribes and encouraging the use of secondary markets to facilitate broadband deployment to unserved or underserved tribal areas.⁶ However, the inactivity and dormancy since WT 11-40 has stifled the promise of increasing tribal access to commercial wireless spectrum licenses. While some of the proposals contained in the NPRM are agreeable, we propose additional recommendations and clarifications for the FCC to create a ‘Tribal Priority’ to commercial wireless spectrum.

Specifically, the creation of a Tribal Priority should recognize that not all tribes may have the desire to develop their own wholly or partially owned, controlled, and operated telecommunications companies. The law must recognize that, in lieu of these companies, tribal governments should have the authority to hold spectrum licenses, thereby allowing tribal governments negotiating influence with service providers. Creation of a Tribal Priority to commercial wireless spectrum advances tribal self-determination, and upholds the federal government’s fiduciary trust responsibility to tribal nations. The FCC itself has stated that it, “has long been committed to promoting the government-to-government relationship between the Commission and federally-recognized tribes”,⁷ and, “we recognize that the legal foundation for providing opportunities to Tribes for access to spectrum is based on the federal government’s trust relationship with Tribal governments.”⁸

II. CREATION OF A LEGAL AUTHORITY FOR TRIBES TO REGULATE SPECTRUM HOLDERS

In recognition that not all tribes may want to develop their own telecommunications companies, certain legal authorities should be granted for tribal governments to regulate carriers holding spectrum over tribal lands. Spectrum auctions that occurred years, if not decades ago, have allowed carriers to hold spectrum over lands that many have not deployed wireless services to. While it can be argued that carriers have deployed to *some* tribal areas, many of these reflect the most populous or most traveled areas. Carriers have been typically driven by market forces to connect large population centers, and provide wireless coverage along interstate and highway roads to ensure returns on investments. Tribal lands, much like the rest of rural America, have historically been overlooked by telecommunications carriers. But unlike many rural areas across the country, tribal governments have considerable barriers to deploy communications infrastructure. Such barriers include, but are not limited to, lack of access to capital, collateralization of assets for credit, and the lack of a typical tax base or structure that rural municipalities exercise.

Many of these issues were raised when the FCC sought comments on the auction procedures for the Tribal Mobility Fund. For instance, the Tribal Mobility Fund was structured to provide

⁶ See Federal Communications Commission. *In the Matter of Improving Communications Services for native Nations by Promoting Greater Utilization of Spectrum Over Tribal Lands*. Notice of Proposed Rulemaking. WT Docket No. 11-40. Paragraph 12, page 6. Available at <http://apps.fcc.gov/ecfs/comment/view?id=6016822908>.

⁷ *Id.* Paragraph 2, page 2.

⁸ *Id.* Paragraph 24, page 10.

incentives to service providers through a reverse auction process, which rewards the bidder seeking the lowest level of support from allocated funds. While this process could efficiently conserve Tribal Mobility funds, it assumes that participating bidders have sufficient capital to build those telecommunications systems and infrastructures, thereby requiring minimal financial assistance from the USF. This assumption is an unfortunate oversight of the access to capital issues tribal nations experience nationwide. Such capital was required to become a qualified bidder and obtain an irrevocable letter of credit (LOC). The requirements of an LOC, essentially a performance bond, is particularly difficult for tribal nations whose principal assets—tribal lands—are often held in trust and therefore incapable of being pledged as collateral.

If wireless telecommunications services are to become a reality on *all* tribal lands, then tribal nations must be empowered to regulate current spectrum holders operating on these lands. For instance, the Navajo Nation Telecommunications Regulatory Commission (NNTRC) was created by the Navajo Nation to regulate telecom service providers operating on their lands. However, these service providers have not always been fully compliant with NNTRC proposals for deployment on tribal lands due to current legal frameworks that exclude tribes from exercising this inherent sovereign power.

III. CLARIFY THE DEFINITIONS OF TRIBAL LANDS AND GEOGRAPHIC SERVICE AREAS

Spectrum, much like tribal lands, is confined to certain geographic areas due to the FCC's management of licenses for different bands and frequencies. If a 'Tribal Priority' is to be created to commercial wireless spectrum, then it must take into account that tribal lands and FCC market areas for spectrum do not align. If a tribe wants to obtain a commercial wireless spectrum license to serve its land base, then there needs to be a clear understanding of what constitutes 'tribal land', and re-designating these areas must be accomplished to reflect those proposed service areas. Spectrum regions should unite communications services on tribal lands, not divide them.

In WT 11-40, the FCC proposed a definition of tribal lands that is similar to the definition established under the Tribal Lands Bidding Credit Program.⁹ Unfortunately, that proposed definition limits the definition of 'tribal lands' stated in the *NBP*. In addition to the language proposed in WT 11-40, the definition of 'tribal lands' should include, "... American Indian Reservations and Trust Lands, Tribal Jurisdiction Statistical Areas, Tribal Designated Statistical Areas, and Alaska Native Village Statistical Areas, as well as the communities situated on such lands. This would also include the lands of Native entities receiving federal acknowledgement or recognition in the future."¹⁰ Adopting this definition of 'tribal lands' as recognized in the *NBP* will

⁹ *Id.* Paragraph 18, page 8.

¹⁰ See *National Broadband Plan*, Chapter 3, "Current State of the Ecosystem." Page 26, footnote 71. "For the purposes of the Plan, we define 'Tribal lands' as any federally recognized Tribe's reservation, pueblo and colony, including former reservations in Oklahoma, Alaska Native regions established pursuant to the Alaska Native Claims Settlement Act (85 Stat. 688), and Indian allotments. The term 'tribe' means any American Indian or Alaska Native Tribe, Band, Nation, Pueblo, Village or Community which is acknowledged by the Federal government to have a government-to-government relationship with the United States and is eligible for the programs and services established by the United States." See Statement of Policy on Establishing a Government-to-Government Relationship with Indian Tribes 16 FCC Rcd 4078, 4080 (2000). Thus, 'Tribal lands' includes American Indian Reservations and Trust Lands, Tribal Jurisdiction Statistical Areas, Tribal Designated Statistical Areas, and Alaska Native Village Statistical Areas, as well as the communities situated on such lands. This would also include the lands of Native entities receiving federal acknowledgement or recognition in the future. While Native Hawaiians are not currently members of federally-recognized Tribes, they are intended to be covered by the recommendations of this Plan, as appropriate."

protect tribal interests and advance opportunities for tribes to obtain spectrum licenses to provide wireless services on their lands.

IV. ADOPTION OF A 'BUILD OR DIVEST' RULE

In WT 11-40 the FCC acknowledged that a 'Build or Divest' rule has consistently been sought after by tribes as a means to incentivize telecommunications infrastructure deployment on tribal lands.¹¹ At paragraph 54 of WT 11-40, the FCC proposed a process for tribes to initiate a 'Build or Divest' proceeding beginning with the filing of a 'Notice of Intent'. The FCC proposed this mechanism to collect information from licensees purportedly demonstrating they have satisfied final construction requirements of the license obtained. This information collection would assist the FCC and tribal nations in determining the extent, or lack, of infrastructure deployment on tribal unserved and underserved lands.

Additionally, the FCC proposed that if a 'Notice of Intent' process were adopted that the licensee should be required to follow procedures proposed in WT 11-40, which stated that, "... the licensee should have to indicate whether it would agree (a) to extend coverage to the Tribal land(s), or (b) relinquish its authorization for the unserved or underserved Tribal land within the geographic area of its license."¹² Further discussions regarding these proposals are warranted as tribal specific issues regarding infrastructure deployment on tribal lands are particularly unique.

There are 566 federally-recognized tribes in the U.S. and each one is unique, especially when taking into consideration their specific communications priorities and goals. Some tribes may have, or are currently in the process of developing, relationships with communications providers already on tribal lands. The key issue here is that tribes are empowered sovereign nations and each tribal nation has their own priorities, which may or may not include spectrum management rights at this moment in time. However, the opportunity to obtain and retain spectrum licenses should always be available and afforded to tribal nations as a core principle of 'self-determination' and inherent tribal sovereignty.

Ultimately, adoption of a 'Build or Divest' process will empower tribal nations to determine and set their own telecommunications priorities through understanding of their community's needs. The 'Build or Divest' rule should be adopted for both current spectrum license holders and those obtaining future licenses so that all tribes will be afforded equal opportunities to obtain much needed spectrum licenses. If the FCC were to adopt this 'Build or Divest' process for only prospective spectrum license awards, it would do little to resolve the current, dire state of telecommunications services on tribal lands. Enabling a 'Build or Divest' process on current license holders will accomplish one of two possibilities: (1) incentivize communications providers to further deploy these vital services to connect unserved and underserved tribal lands; or (2) empower tribes, recognized by the federal government as inherent sovereign entities, to initiate a process that adheres to and supports tribal self-determination and sovereignty.

If telecommunications providers refuse to work in coordination with tribes and tribal entities for the deployment of wireless services, then those providers should be required to divest their

¹¹ See Federal Communications Commission. *In the Matter of Improving Communications Services for native Nations by Promoting Greater Utilization of Spectrum Over Tribal Lands*. Notice of Proposed Rulemaking. WT Docket No. 11-40. Paragraph 53, page 18. Available at <http://apps.fcc.gov/ecfs/comment/view?id=6016822908>.

¹² *Id.* Paragraph 55, page 19.

spectrum licenses over tribal lands. Once these licenses are divested then a 'Tribal Priority' should follow the proposals set out by the FCC in WT 11-40, which states, "a qualifying Tribal entity for these purposes would be an entity designated by the Tribal government or governments having jurisdiction over particular Tribal land for which the spectrum access is sought . . .", and, " . . . that only the following may be designated as qualifying Tribal entities: (1) Tribes; (2) tribal consortia; and (3) entities that are more than 50 percent owned and controlled by a Tribe or Tribes."¹³

CONCLUSION

The recommendations made in these comments are designed to assure that all tribal lands, not just the portions most economically desirable for carriers, are connected to robust wireless services. Tribal governments and telecommunications providers must have sufficient access to spectrum to support efforts to deploy next-century wireless communications services. Any consideration to update the Telecommunications Act of 1996 must take into consideration the barriers and opportunities for tribal access to spectrum licenses. If you have any questions or comments please contact NCAI Legislative Associate, Brian Howard, at [REDACTED]

Sincerely,

Jacqueline Pata
Executive Director
National Congress of American Indians

¹³ *Id.* Paragraph 23, pages 9-10.

Endnotes

ⁱ Timeline of tribal comments submitted for the record to the FCC – WT 11-40, in the Matter of *Improving Communications Services for Native Nations by Promoting Greater Utilization of Spectrum over Tribal Lands*.

1. Comments of the National Tribal Telecommunications Association. May 20, 2012. Available at <http://apps.fcc.gov/ecfs/document/view?id=7021649502>.
2. Joint Reply Comments of the National Congress of American Indians and Native Public Media. June 20, 2011. Available at <http://apps.fcc.gov/ecfs/document/view?id=7021688922>.
3. Reply Comments of the Navajo Nation Telecommunications Regulatory Commission. June 20, 2011. Available at <http://apps.fcc.gov/ecfs/document/view?id=7021688836>.
4. Ex-Parte Filing of the FCC Office of Native Affairs and Policy. August 8, 2011. Available at <http://apps.fcc.gov/ecfs/document/view?id=7021701417>.
 - Ex Parte Attachment – NCAI Resolution MKE-11-007, *In Support for a Tribal Priority for the Utilization of Spectrum on Tribal Lands*. Available at <http://apps.fcc.gov/ecfs/document/view?id=7021701418>.
5. Ex Parte Filing of the FCC Office of Native Affairs and Policy. August 12, 2011. Available at <http://apps.fcc.gov/ecfs/document/view?id=7021702499>.
 - Ex Parte Attachment – NCAI White House Native American Business Leaders Roundtable: Briefing Materials. Available at <http://apps.fcc.gov/ecfs/document/view?id=7021702500>.
6. Ex Parte Filing of the FCC Native Nations Broadband Task Force. August 18, 2011. Available at <http://apps.fcc.gov/ecfs/document/view?id=7021703530>.
7. Ex Parte Filing of the Navajo Nation Telecommunications Regulatory Commission. October 28, 2011. Available at <http://apps.fcc.gov/ecfs/document/view?id=7021746289>.
8. Letter from the National Congress of American Indians. *Emphasizing the Importance of a Tribal Priority to Spectrum Licenses (Improving Communication Services for Native Nations by Promoting Greater Utilization of Spectrum over Tribal Lands, WT Docket No. 11-40)*. July 20, 2012. Available at <http://apps.fcc.gov/ecfs/document/view?id=7021991131>.
 - Filing Attachment – NCAI Resolution LNK-12-007, *Spectrum Allocation and the Low Power FM Radio (LPFM) 'Tribal Priority'*. Available at <http://apps.fcc.gov/ecfs/document/view?id=7021991132>.
9. Letter from the National Congress of American Indians. *National Congress of American Indians Adopts Resolution #SAC-12-034 Promoting Tribal Nation Access and Use of Spectrum for Communications Services (WT Docket 11-40)*. November 6, 2012. Available at <http://apps.fcc.gov/ecfs/document/view?id=7022038975>.
 - Filing Attachment – NCAI Resolution SAC-12-034, *Promoting Tribal Nation Access and Use of Spectrum for Communications Services*. Available at <http://apps.fcc.gov/ecfs/document/view?id=7022038976>.
10. Ex Parte Filing by Gila River Telecommunications, Inc. and Mescalero Apache Telecommunications, Inc. April 26, 2013. Available at <http://apps.fcc.gov/ecfs/document/view?id=7022302362>.
11. Comments of the Navajo Nation Telecommunications Regulatory Commission. *In the Matter of Tribal Mobility Fund Phase I Auction and WT 11-40*. May 5, 2013. Available at <http://apps.fcc.gov/ecfs/document/view?id=7022312278>.
 - Filing Attachment – Supplemental Exhibits. Available at <http://apps.fcc.gov/ecfs/document/view?id=7022312279>.
12. Comments of the Navajo Nation Telecommunications Regulatory Commission *In the Matter of Tribal Mobility Fund Phase I Auction and WT 11-40*. Supporting Petition for Reconsideration. September 16, 2013. <http://apps.fcc.gov/ecfs/document/view?id=7520944081>

March 18, 2014

The Honorable Fred Upton
Chairman
Committee on Energy and Commerce
US House of Representatives
2125 Rayburn House Office Building
Washington, DC 20515

Dear Chairman Upton:

Thank you for soliciting comments from all interested parties as you examine the communications industry and the Communications Act in the #CommActUpdate effort. In our review of submitted comments, we noticed several important issues affecting rural electric cooperatives addressed in comments submitted by other stakeholders. In order to ensure the committee has complete and accurate information, we feel compelled to provide additional comments on these issues to the committee at this time.

The National Rural Electric Cooperative Association (NRECA) is the national service organization for more than 900 not-for-profit rural electric utilities that provide electric energy to over 42 million people in 47 states or 12 percent of electric customers. Electric cooperatives are private, independent electric utilities, owned by the members they serve. Electric cooperatives own and maintain 2.5 million miles or 42 percent of the nation's electric distribution lines, covering 75 percent of the U.S. landmass. Co-ops serve an average of 7.4 consumers per mile of line and employ 70,000 people in the United States.

The white paper, *Modernizing the Communications Act*, presented several questions seeking stakeholder input. We are writing in response to the second question, and ask the committee to consider three issues, the electric cooperative exemption from the federal pole attachment statute, the need for broadband deployment in rural areas, and electric utilities need for spectrum.

As a starting point, we recognize the three principles underlying the Act. Two of these principles -- universal service and consumer protection-- are critical to the ability of telecommunications providers and the FCC to be able to provide services to rural America. We agree with NTCA's comments that the third principle -- "market based frameworks" simply does not apply in rural America. The lack of markets in rural America for telecommunications services makes the framework unworkable for electric co-ops. Unless and until markets develop in rural areas for these services, we encourage your analysis to provide for other mechanisms to ensure that rural Americans receive modern telecommunications services.

2. What should a modern Communications Act look like? Which provisions should be retained from the existing act, which provisions, need to be adapted for today's communications environment, and which should be eliminated?

Electric Cooperative Pole Attachment Exemption Should be Retained.

First and foremost, the Committee should maintain the cooperative exemption from the federal pole attachment statute and reject any recommendation from telecommunications or broadcast interests that electric cooperatives should be subject to federal pole attachment regulations.

In 1978, Congress acted to speed deployment of cable television service. Among other initiatives, Congress provided for federal regulation of pole attachments. It gave the FCC jurisdiction over rates, terms and conditions for cable lines attached to investor-owned utilities' poles unless a state chose to regulate pole attachments. Recognizing the unique, locally-directed governance of electric cooperatives, Congress exempted electric cooperatives from the pole attachment provisions and did not disturb that exemption in the 1996 reauthorization of the Telecommunications Act.

In the 1978 statute and continued in the 1996 Act, Congress specifically allowed state pre-emption of federal regulation where states certify to the FCC that they regulate rates, terms and conditions for pole attachments. Eighteen states and the District of Columbia have exercised this right to regulate pole attachments. Depending upon the scope of a state's public utility commission jurisdiction, some of these states regulate electric cooperatives' pole attachments.

During debates on the 1978 Pole Attachment statute, Congress clearly expressed an interest in preserving a balance of state vs. federal authority, stating, "The Committee considers the matter of CATV pole attachments to be essentially local in nature, and that the various state and local regulatory bodies which regulate other practices of telephone and electric utilities are better equipped to regulate CATV pole attachments.... It is only because such state or local regulation currently does not widely exist that federal supplemental regulation is justified."

Congress recognized an important distinction for electric cooperatives when it stated that "cooperatively owned utilities, by and large, are located in rural areas where often over-the-air television service is poor. Thus customers of these utilities have an added incentive to foster the growth of cable television in their areas ... pole rates charged by municipally owned and cooperative utilities are already subject to a decision-making process based on constituent needs and interest." That statement is as true today as it was in 1978. Today's electric cooperatives are similarly motivated by their consumers' desire for broadband and other advanced services.

In order to maintain 501(c)(12) tax-exempt status, cooperatives charge cost-based rates for their services, including pole attachments. Often, cooperatives charge rates that do not fully recover all of their costs, especially considering that pole attachments may cause operational and/or safety problems. If a federal uniform rate pushed attachment rates lower than actual costs, electric co-op consumers would wind up subsidizing cable, broadband and telecommunications corporations.

The local, democratically elected Boards of Directors of Electric Cooperatives are responsible for ensuring that the integrity of the cooperatives' distribution lines and poles is maintained. Local regulation of pole attachments ensures that cooperative boards and management can facilitate the deployment of cable, telecommunications and broadband services while protecting the critical infrastructure that brings essential power to homes and businesses.

Rural Broadband Deployment

Rural electric cooperatives were formed to provide reliable electric service to their owner members at the lowest reasonable cost and are dedicated to improving the communities in which they serve. Management and staff of rural electric cooperatives are active in rural economic development efforts. NRECA's members rely on a mix of wireless and wireline telecommunications services to support and maintain their rural electric distribution systems. Rural electric cooperatives depend on robust telecommunications infrastructure and services to support their smart grid and other operational applications and, in some cases, to offer broadband services to their members in order to support their commitment to spur economic development in the communities in which they serve.

The first decade of the 21st century has come and gone, and in 2014, too many of the communities we serve have inadequate telecommunications service. Without robust broadband, small towns are losing businesses, farmers are losing market share, and rural school children are lagging behind their urban peers. Without robust broadband, America is slowly but surely losing many of the rural places that enrich our national economy and culture.

Despite federal efforts to address the "digital divide" between rural and urban areas, it continues to affect some 15 million U.S. residents. The gap is widening between the urban places with many telecommunications options and the rural places without. The current strategies and approaches aren't working. The FCC's National Broadband Plan and the Connect America Fund were important first steps in addressing this problem, but more still needs to be done.

We encourage the Committee and the FCC to look at alternative plans to bring advanced telecommunications services to rural America. Today's urban-rural digital divide is analogous to the limited scope of rural electrification in the 1930s. The low population numbers and sparse density of households make rural areas more difficult from both a business case standpoint and a service standpoint. The diverse geography of rural areas compounds those difficulties and underscores the point that no single technology will be the solution to bridge the urban-rural digital divide. Given this scenario, NRECA believes it is time to consider the creation of an Office of Rural Affairs at the FCC.

An Office of Rural Affairs within the FCC will create a focus for closing the digital divide, and serve as a focal point to ensure that the FCC gives sufficient consideration to rural issues as it fulfills its multiple other missions in telecommunications. An Office of Rural Affairs within the FCC would be consistent with several of the FCC's current responsibilities including: Encouraging the development of innovative services, Public Safety and Homeland Security, Consumer Information and Education.

Electric Utilities Need Dedicated Spectrum

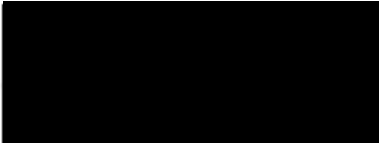
As a critical infrastructure industry, all electric utilities including rural electric cooperatives should have access to dedicated spectrum. With increased national emphasis on grid resiliency and cybersecurity, we urge the committee to consider the case for giving electric utilities (and other critical infrastructure industries), dedicated spectrum.

Particularly in rural America, our electric cooperatives simply don't have the resources to compete with large national incumbent carriers, to bid for spectrum in auctions.

Utilities are among the largest users of communications technology. We rely on robust, available networks for the operation of our SCADA networks, for storm restoration activities and for smart meter technology, which allows us to pinpoint outages, speeding repairs and return to service.

We appreciate the opportunity to provide these comments and we look forward to working the Committee as it undertakes this important assessment of the Communications Act.

Sincerely,



Tammy K. Embrey
Senior Legislative Advisor
NRECA

**NTCA–The Rural Broadband Association
Comments in Response to
U. S. House of Representatives Energy &
Commerce Committee White Paper 2:
Modernizing U.S. Spectrum Policy
(Released April 1, 2014)**

April 25, 2014

INTRODUCTION

Congress and the FCC play a key role in ensuring that consumers living in rural areas can enjoy the benefits of affordable access to cutting-edge communications services to the same extent as consumers living in urban areas. Rural consumers, like their urban counterparts, depend on a complementary mix of fixed and mobile wireless services to fulfill their social and business needs. When it comes to mobile services, however, rural areas often receive subpar or no service by large, nationwide providers, who understandably concentrate their build-out efforts and resources in more profitable, easier to serve, urban areas where there are larger addressable markets. For this reason, rural consumers often depend on smaller, local wireless providers for service in the areas where they live and work. But in order to provide service to rural areas, smaller wireless providers must have access to spectrum. Regardless of where consumers live, demand for wireless broadband services is surging as equipment used by consumers to access content via wireless connections proliferates.

With this backdrop, NTCA submits the following response to the specific questions posed by the committee:

- 4. Given the enormous economic benefits of innovation spurred by commercial spectrum availability, both the government and the private sector are concerned with making more spectrum available to meet commercial demand. When discussing available resources, the FCC considers spectrum to be “currently available” if providers have the legal authority to build out and provide services using that band, or “in the pipeline” if it is not currently available for commercial services but there are government plans to make it available to commercial providers within the next three years. Congress and the FCC have worked to increase the amount of spectrum available to commercial providers, including through the provisions for auctions and relocation in the Middle Class Tax Relief and Job Creation Act. What other steps can be taken to increase the amount of commercially available spectrum?***

While some carriers complain about a spectrum shortage and the need for additional spectrum resources, there remain swaths of spectrum that are currently licensed, but unused – primarily in rural markets. Heavy device users in heavily populated areas drive spectrum demand in urban and suburban markets and precede the call for more spectrum to be made

available. These same market drivers cause large carriers to focus their build out efforts in these profitable markets. However, much spectrum has been licensed according to overly large geographic areas that include less profitable, rural markets that remain unserved or underserved as spectrum holders concentrate their investments and focus their operations in the more populated portions of those over-sized license areas.

The FCC should be encouraged to adopt rules and policies that remove fallow spectrum from the hands of larger providers with little incentive to use it, and put it into the hands of smaller providers with the ability, incentive and desire to serve rural communities. Spectrum should be reclaimed by the FCC only after a reasonable build out period has passed and the Commission determines that usable equipment is readily available. The mere threat of spectrum being reclaimed may also push larger carriers with unused spectrum to deploy service, rather than risk losing a valuable spectrum asset. Whether the spectrum is reclaimed and re-licensed or the larger carrier builds out rather than lose the spectrum, the rural consumer benefits with increased access to wireless service.

This reclamation of spectrum would help ensure rural service, rather than allowing rural portions of large license areas to stay “on hold” pending some future deployment that may never come.

- 5. In order to issue spectrum licenses, the Communications Act requires the FCC to make an affirmative finding that granting the license serves the public interest, convenience, and necessity. Moreover, the Act prohibits the FCC from basing its finding on the expectation of auction revenues. Should the Act permit the FCC to use expected auction revenue as the basis for a public interest finding? What criteria should the FCC consider as part of its analysis?***

Spectrum is a limited public resource. The Commission should at all times make sure that spectrum is put to its highest and best use. The public interest, convenience and necessity drive the policy decisions and should continue to do so. The Commission should ensure that every consumer has the opportunity to enjoy the benefits of a robust and competitive wireless

marketplace. The ability to influence a one-time contribution to the treasury in the form of auction revenues should not be the basis of a public policy determination with respect specifically as to whether the intended or proposed use of that spectrum serves American consumers.

7. *Finite supply and ever increasing demand have created the scarcity around which the FCC's regulatory controls are based. The FCC has placed limitations on spectrum holdings in a number of ways. In mobile wireless, the Commission has implemented policies that included the cellular cross-interest rule, the Personal Communications Service (PCS) cross-ownership rule, and the Commercial Mobile Radio Services spectrum cap. Currently, the Commission conducts a case-by-case analysis of spectrum aggregation for each entity. The two-part "spectrum screen" first analyzes changes in market concentration that would result from the proposed transaction, and then examines the amount of spectrum that is suitable and available on a market-by-market basis. Prompted by the passage of the Middle Class Tax Relief and Job Creation Act, the FCC initiated a proceeding to review existing policies regarding mobile spectrum holdings to determine whether they still satisfy the statutory goals of promoting competition and avoiding excessive concentration of licenses, given changes in technology, spectrum availability, and the overall marketplace. The FCC has considered other tools to try and enhance competition within the wireless services market. Among these are spectrum "set-asides," where blocks of spectrum are reserved for a particular type of bidder; bidding credits, which provide a discount on winning bids to small businesses or to specific groups like women and minorities to encourage bidding; and auction design, including reserve prices, package bidding, and proposed restrictions on bidder eligibility. Given the complexity of spectrum auctions, these policies have been criticized for altering the playing field and distorting outcomes. What principles should Congress and the FCC consider when addressing spectrum aggregation limits? How has the converging marketplace and growing demand for services changed the discussion of spectrum aggregation?*

The wireless marketplace has seen significant consolidation in the decade since the Commission's last review of its spectrum holdings policies. In 2003, there were six nationwide mobile telephone operators; as a result of mergers and other Commission approved transactions, there are now four nationwide providers. The two largest carriers, AT&T and Verizon, control more than a combined 70% of the U.S. wireless market. This market concentration and the resulting consolidation of spectrum is harmful to rural providers and the consumers they serve.

Larger carriers with more resources can often edge out much smaller competitors in a quest for additional spectrum, reasonably priced equipment and favorable roaming agreements. As a

result, smaller carriers too often feel the pressure to exit the market altogether and sell spectrum licenses to the very carriers who help to drive and perpetuate this ecosystem.

The largest providers of wireless service have an obvious and understandable interest in obtaining all available spectrum. Not only does such consolidation increase their bottom line, it also forecloses would-be competitors from gaining a foothold in the market.

Although many smaller providers compete against large carriers for customers, the service provided by the large carriers in rural areas, where available, can often be substandard. Large carriers typically (and understandably) concentrate their build-out efforts and service offerings in profitable densely-populated areas. In contrast, small rural providers focus on the rural communities in which they live and operate, offering high-quality, state-of-the-art service. As a result of these market incentives, rural consumers are often forced to choose between service from either a small carrier with quality local service, but more limited nationwide options, or a large carrier with more device choices and a nationwide calling and data plan, but spotty service “at home.”

In order to ensure that rural consumers have quality service options available from multiple providers and to help provide proper incentives and opportunities for meaningful competition in these markets, small rural providers must have the opportunity and incentive to offer a competitive service offering. Small providers must be given access to the latest technology and consumer devices at prices comparable to larger providers. The inability to purchase in bulk means that only larger providers can drive device development and command the best prices.

Smaller providers also require access to reciprocal roaming agreements according to reasonable rates and conditions. Small providers should have access to the same wholesale roaming rates that larger providers offer their own affiliates. Without reasonable nationwide roaming rates, a smaller provider cannot offer a competitive product. Larger carriers have every

incentive to drive competition from the marketplace and should not be afforded the opportunity to do so.

In order to gain a foothold in the provision of any spectrum-based service, small providers must have the ability to obtain and retain spectrum. Reasonable spectrum aggregation limits would help loosen the stranglehold that the largest providers have on the market – offering opportunities for competitive providers to obtain spectrum to enter the wireless arena or expand wireless offerings with the addition of new, innovative capabilities. Additional players in the mobile wireless market also introduce additional and stronger roaming partners to the benefit of consumers and the market as a whole.

Specifically, there should be overall spectrum aggregation limits, with additional specific limits on spectrum below 1 GHz. Limits on the total amount of spectrum any one carrier can hold in a given market would ensure that consumers have the opportunity to choose to receive service from more than one provider and it would help increase innovation and the variety of service offerings.

Rural providers have a particular interest in additional aggregation limits on spectrum below 1 GHz. Spectrum below 1 GHz allows for better coverage across large geographic areas and is inherently technically superior to spectrum above 1 GHz. Importantly for rural providers, low-band spectrum signals travel a greater distance than high-band spectrum, allowing for the construction of much fewer towers. Tower construction is costly, particularly in rural areas, and small providers have very limited resources. Rural areas simply lack the population density to support the multiple towers necessary to offer a reasonable wireless product using high-band spectrum. The Commission and Congress should take reasonable steps to ensure that no company is provided the opportunity to obtain all that remains of low-band spectrum in any given market.

- 8. The FCC further promotes efficient use of spectrum through the build-out requirements and operating rules attached to licenses. Build-out rules require licensees to construct and activate infrastructure within a certain timeframe, or risk losing that license. The operating rules require some licensees to return a license if not used for any 12-month period after construction, promoting the active and continual use of spectrum. These provisions help to ensure that spectrum that is not fully utilized becomes available to those who will put it to dynamic use. Should the Act promote competitive and efficient use of spectrum in this way? How effective is the current Act in doing so? How effectively has the FCC used the tools at its disposal to encourage competition?**

See answer to number 4.

- 10. The other governing body of domestic spectrum use is the National Telecommunications and Information Administration (NTIA), which has the authority to assign spectrum frequencies to all federal government owned or operated radio stations under section 305 of the Communications Act. NTIA manages the federal government's use of spectrum, in coordination with the FCC. Distinctions between "federal" or "non-federal" bands of spectrum are administrative creations made through agreements between the FCC and NTIA. The Spectrum Act required NTIA to work with the FCC to identify specific bands for release to commercial use and how to repurpose resources from federal to commercial use, with priority given to options that assign spectrum for exclusive, non-federal use through competitive bidding. In a report on reducing duplication in the federal government, GAO identified spectrum management as 'fragmented' between NTIA and the FCC and urged coordination. What role should NTIA play in the licensing and management of spectrum? Is their current role appropriate and necessary, given the potentially duplicative functions of the FCC and NTIA in spectrum allocation and assignment?**

The FCC regulates all non-federal government spectrum use and is the legislative branch's telecom policy maker and Congress' principal advisor on telecom policy. NTIA regulates all federal government spectrum use, makes telecommunications policy for the executive branch and is the President's principal advisor on telecommunications policy. The two bodies regulate a single limited spectrum asset.

There is much overlap between the roles of the FCC and the NTIA and there exists a potential for inefficiencies and inconsistencies. Although the agencies may be well coordinated, the silos created by this structure compel significant process and allow little room for innovative approaches to spectrum policy. Under the direction of a single agency, the government could more readily strategize the best spectrum policy by looking at new technical and policy solutions

to create an efficient ecosystem. For example, it may be possible to allow commercial utilization of spectrum with prioritization of government use as needs arise. There is currently no ability to consider any shared use approach.

The FCC, as the primary driver of spectrum policy in this country, is well positioned to take over the regulator and advisory role for all spectrum.

CONCLUSION

Unleashing the power of the wireless revolution in rural areas requires access to spectrum, the lifeblood of wireless services and a resource that is in short supply. It also means ensuring that those who obtain such spectrum have the incentive and interest to use it, rather than merely treating the rural portion of that spectrum as a “tag-along” to much more desired parts. Useful access to wireless services will be denied or at best severely hampered unless federal law and policy affords small and regional wireless providers an opportunity to secure the resources essential to serving consumers that may otherwise be ignored by larger carriers.



House Committee on Energy & Commerce
#CommActUpdate: Modernizing the Communications Act
PCIA Comments on “Modernizing U.S. Spectrum Policy”

PCIA – The Wireless Infrastructure Association (“PCIA”)¹ submits these comments in response to the House Committee on Energy and Commerce’s (“Committee”) white paper memo, “Modernizing U.S. Spectrum Policy,” as part of its series of memos investigating how the Communications Act of 1934 (“Act”) can be updated and improved. While spectrum plays a vital role in modern wireless communications networks, the Committee should not overlook the importance of wireless infrastructure in facilitating the efficient use of spectrum. PCIA looks forward to the opportunity to fully discuss the issues facing wireless infrastructure providers in an infrastructure-focused white paper, but would like to take this opportunity to highlight some areas where spectrum and infrastructure converge.

Leadership at the Federal Communications Commission (“FCC” or “Commission”) has recognized how infrastructure can support and enhance spectrum. FCC Commissioner Ajit Pai recognized that while infrastructure is not often discussed, “without vast networks of towers, rooftop antennas, microcells, picocells, distributed antenna systems (DAS), and other types of physical infrastructure, Americans wouldn’t be able to send emails, surf the web, or watch video

¹ PCIA is the national trade association representing the wireless infrastructure industry. PCIA’s members develop, own, manage, and operate towers, rooftop wireless sites, and other facilities for the provision of all types of wireless, telecommunications, and broadcasting services. PCIA and its members partner with communities across the nation to affect solutions for wireless infrastructure deployment that are responsive to the unique sensitivities and concerns of each community.

over their wireless devices.”² Further, Commissioner Jessica Rosenworcel recently pointed out that while spectrum “gets all the glory,” the “unsung hero of the wireless revolution is infrastructure. Because no amount of spectrum will lead to better wireless service without good infrastructure.”³ Spectrum and infrastructure go hand-in-hand to provide consumers with access to high-speed wireless connectivity.

The following comments will address: (1) the interaction of spectrum policy and infrastructure in promoting the efficient use of spectrum; (2) how a Communications Act update could capitalize on infrastructure’s potential to enhance spectrum use by providing clear, predictable standards for the review of infrastructure deployment; and (3) how build-out requirements can be properly constructed to avoid discouraging infrastructure investment.

I. Innovative Infrastructure Can Maximize Efficient Use of Spectrum.

Congress should retain the exclusive-use license model for bringing new spectrum to market, as it remains the most effective way to unleash innovation and investment. The flexibility of the exclusive-use license model allows licensees to utilize spectrum to the fullest extent possible. Under this model, providers experience a clear return on investment, driving both broadband network deployment and innovation. This system creates strong, positive incentives for wireless providers and has formed the bedrock upon which the U.S. wireless industry has constructed the most extensive and robust wireless networks in the world. Congress should reject calls to abandon that extraordinarily successful model.

Congress should continue to view flexible exclusive-use licenses as the primary tool for increasing the amount of commercially available spectrum. This includes encouraging

² *Acceleration of Broadband Deployment by Improving Wireless Facilities Siting Policies*, Notice of Proposed Rulemaking, 28 FCC Rcd 14238, 14322 (2013) (“Broadband Deployment NPRM”) (statement of Commissioner Pai).

³ *Id.* at 14321 (statement of Commissioner Rosenworcel).

government users of spectrum closely examine how they use their spectrum and, where possible, clearing that spectrum for commercial users. In 2010, President Obama issued a memorandum directing heads of federal departments and agencies to work together to unleash the wireless broadband revolution.⁴ In response, the National Telecommunications and Information Administration immediately recommended that some blocks of government spectrum be cleared and reallocated to wireless broadband service by 2015,⁵ and the FCC is preparing to auction that spectrum this fall.⁶ This example illustrates how government users increase commercially available spectrum by examining their own needs. The Committee should consider what steps it can take to encourage government users to clear additional unused spectrum.

Also, newly developed wireless infrastructure will support sharing of government spectrum with other users without harmful interference, unlocking more commercially usable spectrum. In spectrum blocks where exclusive use is not possible, it may be necessary for sharing to play an increasing role. For example, some government uses, like Naval Radar, involve large investments in use of allocated spectrum that would make clearance difficult, but sharing may remain an option for these spectrum bands. Geographic sharing is a well-understood tool of the FCC and offers continued opportunities to maximize the amount of commercially available spectrum. The FCC has also started to consider multi-tiered shared access models and

⁴ Memorandum for the Heads of Executive Departments and Agencies: Unleashing the Wireless Broadband Revolution, 75 Fed. Reg. 38387 (July 1, 2010).

⁵ See U.S. Department of Commerce Takes Major Step Towards Unleashing the Wireless Broadband Revolution, NTIA, Nov. 15, 2010, *available at* <http://www.ntia.doc.gov/press-releases/2010/us-department-commerce-takes-major-step-towards-unleashing-wireless-broadband-re>; *see also* letter from Karl B. Nebbia, Associate Administrator, Office of Spectrum Management, NTIA to Julius Knapp, Chief, Office of Engineering and Technology, Federal Communications Commission (Jan. 19, 2011), *available at* http://www.ntia.doc.gov/files/ntia/publications/ntia_fcc_letter_115_mhz_01192011.pdf.

⁶ See *Amendment of the Commission's Rules with Regard to Commercial Operations in the 1695-1710 MHz, 1755-1780 MHz, and 2155-2180 MHz Bands*, GN Docket No. 13-185, Report and Order (rel. March, 31, 2014); Tammy Parker, *FCC Intends to Auction Two Spectrum Bands in Late 2014*, FIERCE WIRELESS TECH, March 22, 2013, <http://www.fiercewireless.com/tech/story/fcc-intends-auction-two-spectrum-bands-late-2014/2013-03-22>.

unlicensed spectrum sharing in its 3.5 GHz and 5 GHz proceedings, respectively.⁷ Advances in infrastructure technology can enable seamless sharing between incumbents and new users in the aforementioned bands. By deploying small cells that cover targeted geographic areas in these bands, the network can help mitigate interference among user classes and enable more spectrum to be brought to market.⁸ Further, network builds that overlay capacity where it is needed allows existing spectrum to be put to its highest use. In sum, infrastructure can wring the most use out of scarce spectrum resources and therefore should be considered as a cornerstone of sound spectrum policy.

These innovative spectrum sharing solutions promise to improve the efficient use of spectrum, and the private sector is best positioned to respond to these challenges. The private sector can respond more nimbly to technical problems and leverage its experience to work together to develop innovative solutions. Where spectrum sharing is appropriate, the government should not dictate technical solutions. Instead, the government should serve as a monitor to make sure sharing is feasible and that it can continue to efficiently use the spectrum while providing services to the end users.

II. Clear, Predictable Standards for Wireless Infrastructure Deployment Can Support and Enhance Increased Spectrum Availability.

To capitalize on infrastructure's potential to enhance spectrum use, the Communications Act update should ensure infrastructure deployment regulations have clear, predictable standards for review across the country, creating regulatory certainty that encourages investment. PCIA

⁷ See *In re Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band*, Notice of Proposed Rulemaking and Order, 27 FCC Rcd 15594 (2012); *In re Revision of Part 15 of the Commission's Rules to Permit Unlicensed National Information Infrastructure (U-NII) Devices in the 5 GHz Band*, Notice of Proposed Rulemaking, 28 FCC Rcd 1769 (2013).

⁸ See, e.g., Comments of PCIA – The Wireless Infrastructure Association, GN Docket No. 12-354 (Feb. 20, 2013) (3.5 GHz); Reply Comments of PCIA – The Wireless Infrastructure Association, ET Docket No. 13-49 (July 24, 2013) (5 GHz).

encourages the Committee to dive more deeply into infrastructure issues in a separate white paper, but the following examples illustrate how the Communications Act update can maximize spectrum-use efficiency through improved infrastructure approval procedures.

Much progress has been made since the Committee undertook the last major update to the Communications Act in 1996. The Commission interpreted provisions in Section 332(c)(7) to adopt the “Shot Clock,”⁹ establishing 90 days as a reasonable time for zoning decisions regarding collocations, and 150 days for other local siting decisions. Further, the Commission adopted its *Pole Attachment Order* to help ensure timely and rationally-priced access to poles, including the attachment of wireless antennas on pole tops.¹⁰ Both of these advances have ensured that providers can deploy wireless broadband in a timely fashion to keep pace with demand.

Moreover, several federal and state agencies are taking further steps to streamline their review processes for communications facilities. For instance, the FCC took an important step toward speeding deployment with the Acceleration of Broadband Deployment proceeding, released last fall.¹¹ This key proceeding will streamline environmental and historic preservation review processes, implement Section 6409(a), clarify Section 332(c)(7), and solidify a notification exclusion for temporary towers.¹² For its part, FirstNet also opened a proceeding to determine which actions to categorically exclude from environmental and historic preservation

⁹ *Petition for Declaratory Ruling to Clarify Provisions of Section 332(c)(7)(B) to Ensure Timely Siting Review*, Declaratory Ruling, 24 FCC Rcd 13994 (2009) (“*Shot Clock Order*”), *recon. denied*, 25 FCC Rcd 11157 (2010), *aff’d sub nom. City of Arlington v. FCC*, 668 F.3d 229 (5th Cir. 2012), *aff’d*, 133 S. Ct. 1863 (2013).

¹⁰ *Implementation of Section 224 of the Act*, Report and Order and Order on Reconsideration, 26 FCC Rcd 5240 (2011), *aff’d sub nom. American Electric Power Service Corp. v. FCC*, 708 F.3d 183 (D.C. Cir. 2013), *cert. denied*, 134 S. Ct. 118 (2013).

¹¹ Broadband Deployment NPRM.

¹² *See id.*; Comments of PCIA – The Wireless Infrastructure Association, WT Docket Nos. 13-238, 13-32; WC Docket No. 11-59, RM-11688, at 24-53 (Feb. 3, 2014); Reply Comments of PCIA – The Wireless Infrastructure Association, WT Docket Nos. 13-238, 13-32; WC Docket No. 11-59, RM-11688, at 15-26 (Mar. 5, 2014).

review.¹³ Further, building upon the FCC's pole attachment rulemaking, certain state public utility commissions have crafted utility pole attachment processes that encourage competition amongst broadband providers irrespective of delivery method, such as Connecticut; others, such as Ohio, California, and Washington have opened proceedings to examine their pole attachment regulations.

Despite these advances, progress thus far has been incremental; by taking a holistic look at the Act and reexamining patchwork procedures, the Committee can ensure predictability and consistency across the board. As broadband providers build out high-speed networks across the United States, they stand to benefit greatly from the predictability of clear, federal standards. The Committee has the opportunity to promote broadband investment from coast to coast by streamlining review processes for siting communications facilities.

In the past, Congress has indicated its intent to promote clear rules for reviewing infrastructure deployment. Congress saw fit to include Section 332(c), which defines the limits of state and local control of wireless facility siting, during the last rewrite of the Communications Act in 1996. Further, Congress was prudent to enact Section 6409(a), which streamlines the process for minor facility modifications, as part of the Middle Class Tax Relief Act.¹⁴ As such, any update to the Communications Act should build on these examples to promote clear, predictable, technology-neutral standards of review. For instance, as Congress has already recognized the *de minimis* impact of certain wireless deployments, namely insubstantial collocations and modification of existing infrastructure, environmental and historic preservation

¹³ See *First Responder Network Authority; National Environmental Policy Act Implementing Procedures and Categorical Exclusions*, 79 Fed. Reg. 639 (Jan. 6, 2014); *First Responder Network Authority; National Environmental Policy Act Implementing Procedures and Categorical Exclusions*, 79 Fed. Reg. 1363 (Jan. 8, 2014).

¹⁴ Middle Class Tax Relief and Job Creation Act of 2012, 112 Pub. L. 96, Title VI, 126 Stat. 156, 206 (2012); *codified at* 47 U.S.C. § 1455(a).

rules should be constructed similarly. An update to the Act could exempt installations and modifications to communications facilities with a *de minimis* impact from the National Environmental Protection Act and the National Historic Preservation Act's requirements. Further, any update to the Act should ensure state and local regulations reasonably relate to public health and safety.

III. Properly Tailored Build-out Requirements Promote the Public Interest.

When properly applied, build-out requirements can serve the public interest by ensuring spectrum does not lay fallow and encourage service expansion to unserved or underserved areas. However, it is vital that build-out requirements are tailored to prevent them from discouraging investment and therefore slowing deployment. To that end, any requirements imposed on broadband providers must be realistic; Congress should narrowly tailor build-out requirements to meet its stated goals. To ensure the requirements are applied properly in a given situation, Congress should build in some flexibility and permit the FCC to grant waivers should the circumstances require. When codifying build-out requirements, the Committee should carefully consider whether the requirements meet these flexible standards to ensure they encourage investment.

IV. Conclusion

PCIA appreciates the opportunity to comment on spectrum policy, and looks forward to more conversations with the Committee regarding how best to reshape the Communications Act as it pertains to broadband infrastructure deployment. Please do not hesitate to contact the undersigned with any questions.

Respectfully submitted,

/s/ Jonathan M. Campbell
Jonathan M. Campbell
Director, Government Affairs

D. Zachary Champ
Government Affairs Counsel

D. Van Fleet Bloys
Government Affairs Counsel

**PCIA – The Wireless
Infrastructure Association**
500 Montgomery Street, Suite 500
Alexandria, VA 22314
(703) 739-0300

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The Least Efficient Part of Government

By Scott Cleland

Spectrum management is the least efficient part of the federal government.

That's a big national problem because radio spectrum is the essential fuel of the mobile revolution of smart-phones, tablets, video streaming and the Internet of things.

The worst-resource management in the federal government unnecessarily burdens one of the most modern, dynamic and innovative parts of the American economy – mobile.

This is not a partisan issue, it's a good government issue that badly needs fixing – fast. The status quo is indefensible.

Fortunately, Congress is listening.

The House Energy and Commerce Committee has asked all interested parties for input into how to best modernize U.S. spectrum policy as part of the committee's broader legislative effort to update the Communications Act next Congress. Comments are due this week.

The inability of the federal government's spectrum system to make available sufficient federal spectrum for auction, just to keep pace with skyrocketing mobile usage, threatens to become an unnecessary growth cap on the increasingly mobile-driven 21st century economy.

How did the government's spectrum management system become the anachronism it is today?

It was designed for a bygone era – the analog 1900s, not the mobile broadband 21st century.

The obsolete 1992 law in question simply codified a 1978 executive order that established the National Telecommunications and Information Administration (NTIA), which only partially covered spectrum.

To put that in perspective, that means the federal government's basic spectrum management approach predates the first commercialization of cell phones in the U.S. in 1982 – by four years.

At that time most all radio spectrum was used or controlled by government agencies with very little spectrum used directly by consumers or the private sector. That means that spectrum management was, and remains largely today, organized for the convenience of government agencies – not for the benefit of American consumers or the private sector.

The year after that 1992 law fossilized spectrum policy in the analog 1900s, Congress passed a provision in the 1993 Reconciliation Act that authorized spectrum auctions for about 120 MHz of spectrum for personal communications services. In perspective, that auction commercialized 4 percent of the most commercially valuable wireless spectrum between 400 MHz and 3 GHz.

That PCS auction catapulted wireless competition, consumer use, and growth forward. How much? The number of American wireless subscribers exploded more than 3,000 percent from 11 million connections then, to 335 million today.

Currently only about 15 percent of the nation's choice spectrum suitable for commercial broadband is available to the private sector.

Unfortunately in the past few years, the government agencies that control the lion's share of choice spectrum have largely refused to clear more spectrum for private auction. Their offer is to let the private sector "share" some of their spectrum scraps as second class spectrum citizens.

So why is spectrum management the least efficient part of government?

First, the system now can take 9-12 years to make spectrum available for auction. Contrast that with the speed of change in the private sector, where in less than seven years after the invention of the smartphone, about 200 million Americans use one of these new spectrum-hungry devices.

Second, there is no national policy that recognizes spectrum is a scarce valuable resource that must be put to its highest and best use for the nation.

Third, in the current ad hoc spectrum system, literally no one has the authority to ensure spectrum is efficiently and effectively utilized by the government.

Fourth, America's spectrum system scandalously has none of the normal or standard government accountability processes – i.e., decision-making responsibility, budget, accounting, audit, etc. – that is

required of every other valuable government resource like land, buildings, vehicles, personnel, money, telecom services, oil, etc.

Finally, it is obvious that no one is minding the government's spectrum store because no one in government is requiring government agencies to share spectrum better among themselves.

The current claim of a "transformative" spectrum policy that promotes government-private sector sharing of spectrum is less a policy-improvement, and more akin to a policy-surrender to unaccountable government agencies who are unwilling to use their spectrum more efficiently so Americans may benefit.

America currently has a scandalously dysfunctional spectrum system that remains organized for the convenience of government agencies' 1900s needs, not the 21st century needs of consumers, taxpayers and businesses, who need the spectrum as much or more than the government agencies do.

The bipartisan solution is simple – good government.

Like any other trillion dollar resource, someone must be responsible and accountable so that it is put to its highest and best use in both government and in the private sector, and also so that it is not vulnerable to waste, fraud and abuse like it is now.

Congress needs to update U.S. spectrum law to protect our nation's mobile communications future. Without more spectrum available to the private sector, the mobile revolution of smartphones, tablets, video streaming and the Internet of things are at increasing risk of hitting an unnecessary wall in long-term mobile growth.

Congress must legislate to ensure that someone minds the nation's trillion-dollar spectrum store.

Scott Cleland served as Deputy U.S. Coordinator for International Communications & Information Policy in the George H. W. Bush Administration. He is President of Precursor LLC, a research consultancy for Fortune 500 companies, and Chairman of NetCompetition, a pro-competition e-forum supported by broadband interests. www.ScottCleland.com

<http://dailycaller.com/2014/04/24/the-least-efficient-part-of-government/>

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**Telecommunications Act Update
Question Responses - Spectrum
Harold Feld, Senior Vice President,
Martyn Griffen, Government Affairs Associate,
And
Kate Forscey, Policy Fellow
Public Knowledge**

**U.S. House of Representatives
Committee on Energy and Commerce
Subcommittee on Communications and Technology
April 25, 2014**

Public Knowledge appreciates the opportunity to participate in this House Energy and Commerce Committee effort to examine a possible rewrite of the Telecommunications Act. Such a process could take years, but we look forward to a discussion a process that is inclusive of all stakeholders along every step of the way.

The current communications laws have served the nation well and continue to empower the FCC ensure that it works well for all Americans. It has allowed for great innovation and new services that did not exist in 1996. Most importantly, it has remained true to the values that were central to the original crafting of communications law a century before. Laws may be updated or clarified, but it is always important to remember the central reasons for the existing laws and ensure that the public's expectations around their communications networks continue to be protected.

We know that the five questions released by the Chairman of the Energy and Commerce Committee Subcommittee on Communications and Technology are just a portion of a broader discussion. We look forward to continuing the discussion in greater detail through meetings, hearings, and other activities in the future.

Energy and Commerce Spectrum White Paper Responses

1. What structural changes, if any, should be made to the FCC to promote efficiency and predictability in spectrum licensing?

First, all stakeholders and FCC staff must work in a transparent, participatory way to determine the various aspects of designing the upcoming incentive auction, band plan options, and repacking processes. Second, the FCC must enact rules that respect and balance the various goals of the legislation rather than bowing to pressure from one interest in favor of another.

2. What role should unlicensed spectrum play in the wireless ecosystem? How should unlicensed spectrum be allocated and managed for long-term sustainability and flexibility?

Unlicensed spectrum remains one of America's great spectrum innovations. The United States became the first country in the world to authorize flexible access to spectrum through a simple certification mechanism that dramatically lowered barriers to entry and innovation. Unlicensed spectrum in the TV White Spaces (TVWS) represents a unique public resource and an enormous economic opportunity for the US. The unlicensed TV spectrum makes the promise of American entrepreneurialism a reality to those who would otherwise stand excluded on the sidelines, and converts passive consumers into active creators.

It is shortsighted to view unlicensed and licensed as rival. They are compliments that work together. Wherever unlicensed use can take place without interfering with licensed use, the FCC should permit it. As the PCAST report stated in the context of federal spectrum, sharing must become the new norm. Kevin Werbach, Professor of Legal Studies and Business Ethics at The Wharton School, University of Pennsylvania authored a paper on spectrum sharing, "The Spectrum Opportunity: Sharing as the Solution to the Wireless Crunch," that addresses the benefits of spectrum sharing and the shortcomings of spectrum clearing. Prof. Werbach lists five reasons why spectrum sharing should be considered in any response for wireless efficiency:

1. Spectrum sharing increases efficiency and reduces waste
2. Spectrum sharing could offer more, and more useful, dividends to governments
3. Sharing could generate recurring revenue
4. Sharing ensures that spectrum is more accessible, to more people
5. Open and shared spectrum offers benefits for nearly all groups

3. What should be done to encourage efficient use of spectrum by government users?

Public Knowledge agrees with the findings in the PCAST report from July 2012 which concluded that sharing is the most efficient way to utilize spectrum.

While spectrum clearing sounds like an attractive alternative to sharing, spectrum clearing presents numerous shortcomings and relying on clearing creates significant problems. In his paper, Prof. Werbach lists three issues with spectrum clearing:

1. There is no "new spectrum to clear"
2. Reallocating spectrum is slow and expensive, and only likely to become more so
3. Exclusivity encourages spectrum "territoriality."

4. What other steps can be taken to increase the amount of commercially available spectrum?

Maximizing availability of unlicensed spectrum while simultaneously considering what spectrum could be cleared for auction is a two-pronged strategy for success. More importantly, encouraging sharing technology will facilitate future auctions.

5. Should the Act permit the FCC to use expected auction revenue as the basis for a public interest finding? What criteria should the FCC consider as part of its analysis?

No. Auction revenue should not ever be the basis of a public interest finding. The priority of the auction must be to ensure an adequately competitive environment for consumer wireless access nationwide. Any additional consideration of revenue, such as deficit reduction, has too attenuated an effect on the public interest to be taken into account.

Auction revenue should be irrelevant. Money spent at auction is money not spent on build-out, and auction revenue does not equal total revenue from the auction. A more competitive and open spectrum policy is better for the economy and will generate tax dollars that are in excess of whatever you could hope to raise in a one-time auction.

Finally, it is important to distinguish between “auction revenue” and the “free market.” Exclusive licensing and allocation by auction are ways to address interference. They are the equivalent of carbon credits. To treat auction revenue as a public value in and of itself is not merely bad economics it loses sight of the goal of abundant spectrum access. It is the equivalent of outlawing energy efficient technology so that the government could auction more carbon credits.

6. Should all FCC licenses be flexible use? In what instances should the Commission exercise control over the service offered? How can the Act enable better use of spectrum, either flexible or specified?

7. What principles should Congress and the FCC consider when addressing spectrum aggregation limits? How has the converging marketplace and growing demand for services changed the discussion of spectrum aggregation?

The FCC should issue an actual rule on spectrum aggregation, rather than a spectrum screen. A spectrum screen fails to provide certainty and has been used in the past by carriers as a means to relax protections against undue spectrum aggregation.

To the extent that the FCC does maintain a screen, it should at least adopt a tighter screen for low-band spectrum below 1 GHz. As Public Knowledge noted in its initial comments and reply comments in Docket No. 12-268, the FCC should weight spectrum based on its real world utility. It should weight spectrum below 1 GHz as more valuable than spectrum between 1 GHz and 2 GHz, and weight spectrum above 2 GHz as less valuable than either.

The failure to adopt any differentiation among spectrum aggravates rather than alleviates the problem of spectrum concentration by treating concentrations of above 1 GHz spectrum as if it were essentially interchangeable with low band spectrum. Therefore, to the extent that the FCC wishes to actually provide opportunities to companies other than Verizon and AT&T to acquire low band spectrum, it should either (a) adopt a spectrum aggregation approach that recognizes the differences in spectrum below 1 GHz (and above 2 GHz) and weight it accordingly; or (b) adopt an auction specific rule to address 600 MHz spectrum.

8. Should the Act promote competitive and efficient use of spectrum in this way? How effective is the current Act in doing so? How effectively has the FCC used the tools at its disposal to encourage competition?

The policy of efficient use of spectrum by attaching specific build-out requirements is a good one in theory. However, the specific requirements the FCC imposes and the less-than-ideal enforcement currently render the policy ineffective in practice. First, the FCC currently requires the licensees self-certify that they have met build-out requirements, a practice which has rarely lent itself to an optimal degree of industry accountability. Second, the FCC regulations typically are set at a lax point to begin with, making it easy for companies to meet the regulatory goal without necessarily fulfilling what practically would be the best and most efficient public interest standard. Third, even when requirements go unmet, the FCC also grants or dismisses licensee's requests to extend the deadline meeting the requirement. A recent GAO study found that the FCC granted 74% of wireless licensees extension requests.¹ Such overly broad granting of extensions can undermine build-out requirements by creating an impression that they will not be strictly enforced. And finally, in the event that the FCC does strictly enforce, the termination of spectrum contracts does not necessarily lead to the most efficient use of the reclaimed spectrum, either.

These problems can be addressed by simply tweaking the current policy: drop the "use it or lose it" and instead adopting "use it or share it" deployment requirements. A "use-it-or-share-it" requirement would impose similar deployment conditions on spectrum licensees, but in the event that requirements were not met, rather than terminate the contract, it would merely allow for the unlicensed use of the spectrum in question until such time as the licensee fulfills its deployment requirements of the contract. This creates for the FCC to develop and enforce stricter policies with just enough risk to the licensee to incentivize due diligence in meeting requirements. At the same time, it would maximize the public utility in the meantime by authorizing and encouraging the use of otherwise wasted spectrum.

9. What is the best balance between mitigating interference concerns and avoiding limiting flexibility in the future? Can engineering and forward-looking spectrum strategies account for the possibility of unanticipated technologies and uses in adjacent spectrum bands? How do we promote flexibility without unreasonably increasing the cost of services and devices? Does the Act provide the FCC tools to address this problem?

Yes, the FCC has authority over receiver standards and it's no more difficult a problem than it faces with equipment certifications of all kinds.

The device cost issues are overstated but in any event the concern should not be costs to just one segment but overall costs and benefits of having an efficient spectrum policy. Why should cheap receiver manufacturers shift what ought to be their costs to others?

¹ U.S. Gen. Accountability Office, *GAO-14-236: Spectrum Management: FCC's Use and Enforcement of Buildout Requirements* (2014)

All aspects of the ecosystem need to evolve. Artificially protecting receivers encourages inefficiency, imposing costs on everyone.

10. What role should NTIA play in the licensing and management of spectrum? Is their current role appropriate and necessary, given the potentially duplicative functions of the FCC and NTIA in spectrum allocation and assignment?

Public Knowledge has written two white papers on this topic, which we have attached to this document. Please include them in the record.

The Spectrum Opportunity: Sharing as the Solution to the Wireless Crunch

KEVIN WERBACH

The Wharton School, University of Pennsylvania

AALOK MEHTA

University of Southern California

Introduction

We face today a set of policy choices that will define the landscape of the connected world and the United States' place within it. The popularity of smart phones, tablets, and other mobile devices has caused demand for wireless connectivity to skyrocket. Although growth in wireless usage is a longstanding phenomenon, the recent explosion of wireless data traffic is unprecedented, transforming the marketplace in just a few years. Demand will grow for the foreseeable future as wireless systems become increasingly central to social, economic, and political life.

This creates a major public policy imperative. Technical improvements and network upgrades alone will not satisfy this accelerating demand; any sustainable solution will involve expanding access to spectrum for mobile data. Otherwise, limited wireless capacity could become a major drag on U.S. job creation, competitiveness, innovation, community development, and important advances in education, health care, and public safety.

The question is how. All useful frequencies are already assigned, either to government or commercial users. In the National Broadband Plan (Federal Communications Commission, 2010a), the Federal Communications Commission (FCC) established an ambitious goal of freeing up an additional 500 megahertz (MHz) of spectrum for mobile data, but these efforts have run into obstacles. The problem is not a lack of resolve but the cold reality that clearing existing licensees off the spectrum, moving them and their users somewhere else, and auctioning the frequencies to new licensees is increasingly costly, contentious, and uncertain. An approach based entirely on taking frequencies from someone and transferring them to someone else will not maximize capacity over the long term.

What is needed is a change in orientation. Policy makers should acknowledge what engineers already recognize and businesses are already implementing: The future of spectrum is about various forms of sharing. Exclusive rights are still desirable, even essential, in some contexts. However, they will exist within a larger matrix of sharing arrangements to maximize available capacity. Such a policy approach allows the most users and devices to benefit from the airwaves rather than simply picking winners. At the same time, it will extend the long tradition of wireless communication as a mechanism for innovation and free expression.

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In this article, we explore the history of spectrum policy and review advantages and disadvantages of current management practices in light of current technological and economic trends. The evidence suggests that not only is spectrum sharing becoming more important and feasible, but that a framework that makes sharing the default approach offers significant political, economic, and societal benefits. Exclusive-use licenses will still be desirable in many circumstances, but they should have the burden of proof.

The new normal of spectrum sharing may be difficult at first to accept. However, with today's technology, sharing arrangements can be structured to meet the requirements of many categories of users. Conversely, taking spectrum from government or private incumbents and selling it to wireless data providers is far simpler in concept than in execution today. Policy makers should follow the lead of the President's Council of Advisors on Science and Technology (PCAST) and the FCC, both of which have offered recent proposals to reorient spectrum policy around sharing.

Part 1. The Evolution of Spectrum Policy

What Is Spectrum?

Spectrum refers to wireless frequencies used primarily for communication. Wireless communications systems have been commercially viable for more than a century, beginning with broadcast radio and proceeding to television, satellite communications, cellular telephony, and myriad other uses. These industries today touch virtually every American and generate a vast amount of economic activity. However, spectrum differs in important ways from other essential inputs for economic growth and innovation.

As Coase (1959) recognized more than half a century ago, spectrum is no more a definite "thing" than the color palette of visible light in a rainbow; it is an abstraction that reflects technological choices and legal rules. As a result, the effective capacity of the spectrum is a constantly moving target. Frequencies that were unusable in 1970 are now being intensively exploited, for example, while systems that originally reflected state-of-the-art efficiency later become profligate spectrum hogs.

In the first instance, the federal government defines allocation rules for using the spectrum, and assignment rules under which particular entities gain the rights to use it. The goal of spectrum policy is to manage the public airwaves in a way that maximizes societal benefits. For wireless communication, this involves two dimensions: the volume of communication and the value of that communication. All things being equal, more communication is better than less, whether expressed in terms of simple quantity (more television channels or more cellular phones operating at the same time), capacity (higher data rates, allowing for faster connections and richer transmissions such as video), or reliability (messages reaching their destinations consistently).

Of course, all things are not equal. Airwaves have different propagation characteristics based on their frequencies, and transmissions are affected by physical features such as mountains and buildings. Two systems may have different characteristics, making them hard to compare: more throughput versus more reliability, for example. A change that increases capacity may increase costs, require new

equipment, or displace existing users. And some uses are inherently more valuable than others. A lifesaving 911 call should not be displaced by a YouTube entertainment video, even though the video carries more bits. (The trouble is that real-world value choices are rarely so clear-cut.) Finally, a decision optimized for today may block investment or innovation that delivers significantly greater benefits tomorrow.

Every spectrum allocation is thus a bet on the future, involving complex trade-offs. Originally, the government simply added new services at increasingly higher frequencies, where no existing systems operated. For several decades, all frequencies with desirable propagation characteristics have been allocated to either commercial or governmental users. Modern spectrum policy therefore involves a process of continual reallocation, as new systems replace old.

Since the early 1990s, the primary mechanism for deciding who can use reallocated spectrum has been auctions. Although in theory licenses could be assigned through some other mechanism, the ability of auctions to generate up-front revenues is overwhelmingly appealing. Auction revenues can be used to pay for clearing and relocation costs, and the remaining proceeds go directly to the U.S. Treasury. In an environment of fiscal austerity, such revenues are a powerful inducement. However, the one-time financial returns of auctioning spectrum should be distinguished from the ongoing direct and indirect benefits of usage of that spectrum.

Licensed Versus Unlicensed

When transmissions by one wireless system make the operation of another system more difficult, it is called interference. Historically, the most practical means to minimize interference was to split the spectrum into frequency bands and allocate exclusive licenses to transmit in those bands. Each station on AM or FM radio in a given market, for example, is broadcasting simultaneously but using a different frequency band, allowing them to coexist. Within each band, transmissions not by the licensee are prohibited as "harmful interference."

Granting licensees control over slices of spectrum precludes some communication that would not, in practice, cause interference. The amount of such underexploited capacity is quite significant. A recent European study found average spectral occupancy—a measure of the "fullness" of a spectrum band—below 10% (Forge, Horvitz, & Blackman, 2012), and other spectrum surveys report similar results. Historically, however, all nations decided in favor of the greater certainty of licenses. There was seen to be no other viable way to prevent ruinous interference. As a result, frequency-based exclusive licenses take up much of the usable spectrum.

The primary exceptions for communications are scattered segments available on an "unlicensed" basis since the mid-1980s. In bands such as 2.4 GHz and 5 GHz, for example, anyone is free to use the spectrum. Rules are put in place about allowable devices and uses; often these include stipulations that receivers must accept and make do with any interference in the band. In fact, the 2.4 GHz band was once considered a waste area of spectrum because it was choked with interference from industrial devices and microwave ovens. After being opened to unlicensed use, however, the band now houses uses as diverse as WiFi, Bluetooth, cordless phones, radio frequency identification chips, and more. The combination of

FCC Part 15 rules for unlicensed devices and technical standards such as the IEEE 802.11 specifications for WiFi enable these systems and other activity in the bands to coexist.

Unlicensed technologies support increasingly huge markets. In 2012, there were 2 billion Bluetooth devices and 1.5 billion WiFi-enabled devices shipped globally (Meeker, 2012). In markets including mobile broadband, health care, and machine-to-machine communications, unlicensed devices have rapidly taken over a significant market share (Benkler, 2012). The coming "Internet of Things," which will connect tens of billions of devices and sensors, will be even more heavily dominated by unlicensed connections (Thanki, 2013).

For several years, academics have argued the relative merits of the licensed and unlicensed approaches (Benkler, 2012; Hazlett & Spitzer, 2006; Werbach, 2004). Advocates of unlicensed allocations point to the success of WiFi and argue that open access promotes greater innovation as well as democratizes the airwaves. Proponents of licenses counter that only with exclusive control will companies have the certainty to attract capital and make necessary investments for large-scale commercial services. They argue that unlicensed allocations only make sense for "junk" spectrum and short-range services like WiFi, where low power reduces the likelihood of interference and thus minimizes conflicts between simultaneous users (Hazlett & Spitzer, 2006).

Rethinking Sharing

The licensed/unlicensed debate misses the point, however. Both approaches have a place, but they represent two ends of a continuum of sharing. A frequency can be licensed and still shared, for example, if licenses are limited in the scope of the rights they grant. Similarly, unlicensed allocations can be designed to occupy an entire band, as with WiFi, or structured to coexist with other systems. The real question is whether the baseline assumption of spectrum policy should lean toward exclusivity or sharing.

In a sense, all wireless communication involves sharing. Dividing spectrum into frequencies was, in effect, a mechanism to share capacity among unrelated systems. Geographic limitation of spectrum assignments is another kind of sharing. Signal strength restrictions ensure that, for example, a TV station in Los Angeles and one in San Antonio can broadcast on identical frequencies without interfering.

Even within exclusive licenses, sharing has a place. Cellular phone systems are able to reuse the same spectrum by handing off calls whenever a device moves closer to another tower. The next-generation LTE Advanced standard allows multiple carriers to aggregate their capacity for greater performance. In a multiple virtual network operator arrangement, a cellular licensee allows another provider to piggyback on its spectrum by paying a wholesale rate. And virtually all licenses allow for very low-power devices or geographically limited secondary users that are unlikely to cause interference. A recent European study concluded that just 11% of frequencies under 3 GHz were truly exclusively licensed, mostly for radar systems (Forge, Horvitz, & Blackman, 2012); the pattern in the United States is likely similar.

In recent years there has been an explosion of technical innovation around spectrum sharing. The full implications of these developments have not been fully incorporated into spectrum policy debates. Some examples include:

- Software-defined radios that allow devices to change frequencies and modulation schemes dynamically.
- Mesh networking to relay communications from one device to another.
- Heterogeneous networks that overlay short-range “femtocells” and WiFi access points onto conventional cellular networks.
- Secondary markets in which service providers or devices can acquire rights only for a short period of time.
- Systems using databases, either on the devices themselves or through fixed beacons, to instruct devices about available frequencies in a particular area.

Spectrum-sharing mechanisms can be mapped along two dimensions (Peha, 2009; Weiss & Lehr, 2009): coordination (whether devices affirmatively cooperate or simply coexist) and hierarchy (sharing among equals or in primary/secondary relationships). In the discussion below of the relative benefits of sharing versus spectrum clearing, we refer to the full range of possible arrangements, with the recognition that different approaches will make sense in particular cases. However, we emphasize primary/secondary cooperation mechanisms that are likely to be most prevalent in the near term.

Cooperative approaches hold the greatest long-term potential for capacity increases. They can take advantage of the collective intelligence of all devices in the manner most adaptive to existing local conditions, or they can use real-time markets to reallocate spectrum rights. Such systems also involve the greatest computational and economic challenges and require agreements to implement particular protocols. Moreover, existing licensees, whether governmental or private, typically demand guarantees that sharing will not excessively degrade the quality of service on their networks.

To address these concerns, sharing regimes can be structured to operate around existing rights holders. Unlicensed bands, which involve coexistence where no device has greater interference protection than any other, are an option where there is no incumbent service. Otherwise, the greatest opportunity lies in the quadrant of primary/secondary coexistence. Already many examples exist in which one licensee of a frequency is defined as the primary user and other, typically a low-power service, as secondary. The secondary user cannot interfere with the primary user, and it has no protection against interference by that system. This approach can be expanded more broadly to include different classes of primary, secondary, tertiary, and other services within a set of frequencies. Solving the coordination issues involved in sharing is not trivial, but it is becoming easier as devices become more computationally powerful.

Even when spectrum is not shared at the license level, devices today can use multiple radios to create de facto sharing mechanisms. Most smart phones and tablets include WiFi capability. Through these connections, licensed operators are already offloading large percentages of data traffic to unlicensed WiFi nodes. Comcast alone operates more than 55,000 WiFi hotspots. A Comcast executive recently testified that WiFi was now the most popular method of accessing the Web and is a critical form of access during disasters such as the Boston Marathon bombing (Eggerton, 2013).

Confirmation of this trend came from Cisco's most recent Visual Network Index report, widely used as the leading forecast of Internet traffic growth, which dramatically increased earlier projections for WiFi offloading (Cisco, 2013). The new report found that nearly half of all mobile data traffic would flow over unlicensed access points by 2017. Some experts estimate that even that remains a significant understatement (Deans, 2013). New standards for seamless handoffs between access points will expand this phenomenon.

The story of wireless systems today is thus at least as much about sharing as it is about exclusivity. Driven primarily by market forces and technology, vendors and service providers are developing ever more sophisticated ways to exploit the latent potential of spectrum through sharing. However, spectrum policy has not fully incorporated this development.

Part 2: The Spectrum Challenge

The U.S. government has been allocating spectrum for over a century, since the passage of the first Federal Radio Act in 1912. Today, however, it faces an unprecedented challenge. Skyrocketing demand and limited options for creating new supply create the potential for a crisis. Fortunately, this challenge is also an opportunity.

The Data Boom

The history of spectrum policy tells a repetitive story of capacity exhaustion solved by expansion or reallocation. Television, satellites, advanced radars, microwave links, airplane communications, pagers, mobile phones, and many other developments required new capacity. In every case this was achieved with only moderate difficulty. The situation today is different. Improvements in miniaturization and computing have led to unprecedented penetration of reliable wireless connectivity and affordable mobile computing devices, both domestically and globally. And whereas most wireless communication used to involve broadcasting a single transmission to many recipients, today the market has shifted toward far more intensive two-way data conversations among billions of people.

It is instructive to remember that the first iPhone, which kicked off the smart phone boom, was introduced in just 2007. By mid-2013, the installed base of smart phones and tablets worldwide exceeded that of personal computers, and by 2015, there will be twice as many smart mobile devices in use (Meeker, 2012). Overall, analysts predict that by 2020, connected wireless devices worldwide will nearly triple, rising to 24 billion from the current figure of 9 billion (Machina Research, 2012).

The speed of adoption is breathtaking. Apple's iPad hit 100 million units shipped two and a half years after launching. That is triple the growth rate of the iPhone, itself one of the most transformative consumer electronics devices. Android smart phone shipments are growing even faster, and with smart phones representing only half the mobile phone market in the United States (comScore, 2013) and one-sixth of the market worldwide (MobiThinking, 2013), there remains room to grow. At the end of 2012, 29% of U.S. adults reported owning a tablet or e-book reader, up from less than 2% three years before (Meeker, 2012).

Simultaneously, mobile phone service providers have transitioned from voice to data companies. Mobile data demand is expected to grow substantially each year for the foreseeable future, with mobile traffic doubling between the end of 2011 and the end of 2012 and growing by 28% in the last quarter of 2012 alone (Ericsson, 2013). Total data transmitted on mobile broadband networks in 2017 is expected by Cisco (2013) to be nearly 13 times that in 2012. Much of that growth is being driven by mobile entertainment. Verizon Wireless reports that video currently makes up 50% of its mobile traffic and is growing rapidly; by 2017, that figure will expand to two-thirds of all network traffic (Marek, 2013).

Worldwide, twice as many people access the Internet via mobile broadband connections as fixed lines (International Telecommunication Union [ITU], 2012), and mobile usage represented 13% of total Internet traffic in November 2012, up from 1% three years before (Meeker, 2012). Mobile broadband subscriptions are growing at an annual average rate of 40%—faster than any other information or communication technology market (ITU, 2013). In India, mobile broadband already represents a majority of total traffic, a pattern likely to be replicated in the developed world before long (Meeker, 2012). Qualcomm (2012) expects mobile data demand to grow 1,000 times between 2012 and 2020, creating a need for a ninefold increase in available spectrum capacity, even after taking into account new or developing wireless technologies.

This may be just the tip of the iceberg. Machine-to-machine interactions that would allow for remote environmental monitoring, cheap smart grid systems, automatic health care data aggregation, whole house automation, and a plethora of other innovative services are expected to grow 24-fold between 2012 and 2017 (Cisco, 2013). By 2020, there will be an estimated 12 billion such connections worldwide—some half of all mobile connections (Machina Research, 2012). In total, these mobile connections are expected to lead to \$2.5 trillion in new global revenue and another \$2 trillion in cost reductions and service improvements (Machina Research, 2012).

As mobile computing expands, wireless will become the predominant way that most people and companies access the Internet. As such, it is key to all of the many benefits discussed in the U.S. National Broadband Plan (Federal Communications Commission, 2010a) and other sources, including not just expanded business and wealth creation but also e-governance, telemedicine, public safety and emergency response, and more efficient energy usage.

Future growth predictions in fast-changing technology-based industries are inherently uncertain. However, the general trend is undeniable: rapid growth in data-connected mobile devices and increased usage intensity over the next decade. The basic uncertainty lies in how that demand will be met.

Responses to the Wireless Crunch

To address this tidal wave of demand, the National Broadband Plan (Federal Communications Commission, 2010a) recommended freeing up 300 MHz of spectrum within 5 years and 500 MHz over 10 years. About half the spectrum identified for reallocation is currently held by private licensees—primarily television broadcasters—with the remainder controlled by federal agencies. Later in 2010, the Commerce Department outlined its reallocation vision, identifying approximately 115 MHz of federal spectrum to be made available in the next 5 years and as well as a long-range plan for reaching the 500 MHz goal (U.S. Department of Commerce, 2010a; 2010b). In fall 2012, FCC Chairman Genachowski (2012) declared that the FCC was on track to meet the broadband plan recommendations, although significant implementation and other challenges remain.

The most significant chunk of capacity will likely come from “incentive auctions,” which were proposed in the National Broadband Plan and authorized by the Congress in the Middle Class Tax Relief and Job Creation Act of 2012. Many television broadcasters receive virtually all of their revenues from cable or satellite distribution or have ceased operations as the percentage of Americans watching over-the-air signals dwindles below 20%. Nonetheless, even though they explicitly have no ownership rights, broadcasters are reluctant to give up their spectrum licenses, which cover frequencies considered to be “beachfront” spectrum due to their ability to travel long distances and penetrate building walls and other obstacles. Incentive auctions give broadcasters a share of auction revenue if they voluntarily relinquish their licenses.

Incentive auctions are a novel win-win solution that has the potential to unlock significant quantities of underused spectrum. However, the auctions pose enormously complex economic and political challenges, and it remains an open question how much spectrum such auctions will make available, especially in urban areas that make the most intense use of wireless broadband and also host the most lucrative television markets.

The other frequencies that have been marked for potential reallocation are generally spectrum reserved for use by various government departments, such as for radar, military communications, and air traffic control operations. As the commercial importance of wireless communication has expanded and technologies became available to serve these agency missions more efficiently, there have been several cases in which federal spectrum was cleared and then sold to commercial companies. For example, half of a 90 MHz band that sold for auction in 2006 for \$13.7 billion came from federal spectrum (PCAST, 2012).

The National Telecommunications and Information Administration (NTIA) of the Department of Commerce, which oversees federal spectrum, has been working diligently and coordinating with the FCC to repurpose spectrum from government to private use for wireless broadband. However, clearing additional federal spectrum is proving exceptionally difficult and time-consuming. Government and defense agencies use spectrum to support important mission objectives, and making necessary equipment replacements and reconfigurations to support further spectrum transitions can be extremely costly. NTIA concluded that repurposing the 95 MHz of federal spectrum most amenable to clearing—the 1755–1850 MHz band—would still cost some \$18 billion and take 10 years (U.S. Department of Commerce, 2012).

The U.S. General Accounting Office (2013) has concluded that the Department of Defense underestimated the actual relocation costs of the recently cleared 1710–1755 MHz band by almost \$500 million, or 50%.

Although most of the emphasis since the National Broadband Plan has been on clearing frequencies for reauctioning, regulators are also making inroads into additional shared or unlicensed wireless capacity. For example, the FCC (2008b) is moving forward with unlicensed use of “TV white spaces,” unused gaps in the frequency bands allocated for television broadcasting. Significant swaths of this spectrum lie fallow, especially in rural areas, because the original allocations assumed the technical characteristics of 1950s televisions and the number of stations in large urban markets. New technology, however, is expanding the ability of radios to sense their spectral environment and adjust operations in response. The FCC and private parties spent several years testing whether devices could access empty TV bands without harming existing broadcasts (Federal Communications Commission, 2008a). Ultimately, the FCC authorized TV white space radios with the requirement that they check an online database of existing broadcasters before transmitting. The FCC (2011) has subsequently authorized several database providers.

Because white space devices are unlicensed, the spectrum where they operate does not generate auction revenue. This provoked objections from some quarters in Congress. As ultimately passed, the legislation authorizing incentive auctions does not tie the FCC’s hands on making unlicensed white spaces available. However, the technical design of the auctions and associated decisions about how to repack remaining stations into blocks of contiguous frequencies will determine how much effective capacity is available in the TV white spaces.

As technology and market conditions have evolved, other new opportunities for sharing have arisen. A significant portion of the 5 GHz unlicensed band is the result of a 1997 spectrum-sharing arrangement requiring devices to select frequencies to avoid interference with military radars. In early 2013, the FCC proposed expanding the 5 GHz band to further support certain unlicensed uses (Federal Communications Commission, 2013).

The PCAST Report: The Battle Lines Are Drawn

The FCC and NTIA are not the only governmental entities developing new approaches to increase wireless capacity. PCAST (2012), the president’s science advisory board, was tasked to consider the best mechanism to reallocate federal spectrum for commercial uses. It recommended creating a 1,000 MHz superhighway by sharing federal spectrum with commercial users instead of focusing on clearing bands out to reauction for exclusive use. The core conclusion of the PCAST report is that “the norm for spectrum use should be sharing, not exclusivity” (PCAST, 2012, p. vi).

Under the PCAST proposal, frequencies currently controlled by federal agencies would be subject to a hierarchical spectrum access system that offered three tiers of interference protection: incumbent access (which would be protected from harmful interference from other users); secondary access (which would be subsidiary to the federal users but have protection against other private users); and general authorized access (similar to unlicensed systems today, with no guaranteed interference protection). These policies could be enforced by a database system, similar to the one now being deployed for TV

white spaces. The FCC (2012b) has proposed an initial experiment in the 3.5 GHz band using such an approach.

The PCAST proposal focused on federal spectrum because of the group's charge and the difficulties already apparent in clearing and reallocating bands now under the control of government agencies. It offered other proposals such as a synthetic "spectrum currency" to encourage agencies to use spectrum efficiently and make capacity available to the commercial sector. Other authors have similarly focused on federal spectrum in advocating expanded use of sharing (Feld & Rose, 2010; Pickard & Meinrath, 2009). However, there is no technical reason a shared spectrum approach cannot also be used for reallocation of underutilized commercial frequencies.

The PCAST report provoked an intense response. The major wireless carriers criticized its emphasis on sharing as unrealistic and a distraction from the real work of spectrum clearing (CTIA, 2012). One commentator declared that "spectrum 'sharing' has become code among federal authorities to stall for more time" (Downes, 2012), and a Republican staff memo for a House Energy and Commerce Committee argued that "sharing should be reserved for cases in which Federal clearing is impossible" (Eggerton, 2012). In a hearing before that committee, Rep. John Skinkus (R-IL) summed up the opposition: "Having it is better than sharing it. Give it to the dang private sector and see if they can turn a profit" (quoted in Gross, 2012, para. 11).

The severity of the opposition to the PCAST report suggests that we have reached a decision point. As described in the previous section, sharing and exclusivity have long coexisted in the wireless world, with sharing becoming more prevalent as a technical approach over time, including within licensed bands. The explosive growth in wireless demand raises the stakes. Policy makers must decide whether to emphasize clearing or sharing to meet future capacity needs.

Part 3: Sharing as the New Normal

Clearing and reauctioning are necessary pieces of a response to the looming wireless crunch. But are they sufficient? The answer is no. Overemphasis on spectrum clearing will waste opportunities for productive spectrum sharing. This would be a major mistake. Although there is intuitive appeal in Rep. Skinkus' assertion that "having it is better than sharing it," on closer observation, the process of clearing and auctioning spectrum has significant limitations. Spectrum sharing, conversely, has significant benefits that have not been fully included in the policy calculus. Especially when considering the importance of spectrum for innovation, new businesses, free expression, and civic benefit, sharing mechanisms deserve at least as much emphasis as spectrum clearing.

The burden of proof should be on proponents of clearing to show that the benefits of greater exclusivity outweigh those of expanded sharing. There are multiple reasons why that might be true, such as the control necessary to guarantee quality of service or to overlay heterogeneous networks into an integrated service. Those potential benefits, however, should be weighed against the advantages of sharing.

Shortcomings of Spectrum Clearing

The clearing approach has real benefits. Decades-old legacy systems may be wildly inefficient in their use of spectrum. The revenue that auctions generate cannot be ignored, and economic theory suggests that companies' willingness to pay for spectrum will reveal their true demand. Auction revenue may help to convince incumbents such as broadcasters and federal agencies not to create roadblocks that could slow or stop reallocation efforts. Exclusive-use licenses give operators greater certainty, which may be particularly important for services with a large geographic footprint or that require high power and high reliability. And in theory, if given the freedom to resell or subdivide its rights, a licensee will have incentives to do so when such arrangements would be efficient.

Despite these apparent benefits, relying on spectrum clearing creates significant problems: Timely availability of new spectrum capacity is unlikely; clearing causes problems of spectrum access for small and nascent companies; and excessive exclusivity undermines overall efficient use of spectrum.

There is no "new" spectrum to clear. Almost all spectrum that has value for communications is already allocated to existing users, supporting a bewildering array of contemporary applications. Although some of this spectrum is being used with less intensity than other portions, any reallocation involves transplanting existing users in some way. Those users, whether commercial or governmental, are operating systems in which they have made investments, where users have devices in the field, and which are bound up with either financial or mission commitments.

Reallocating spectrum is slow and expensive, and only likely to become more so. Because of the density of existing uses, spectrum clearing involves the time-intensive, expensive process of negotiating with current license holders and upgrading or replacing equipment designed for specific frequency bands. The transition to digital broadcasting for terrestrial television, for example, cost the United States hundreds of millions of dollars and took far longer than anticipated. Overall, the past five spectrum reallocations in the United States have taken from 6 to 13 years each, with three taking a decade or longer (Federal Communications Commission, 2010a, p. 79). And the spectrum bands most amenable to reallocation have already been auctioned off. The process will be longer and more expensive for current bands under consideration.

Exclusivity encourages spectrum "territoriality." Companies that acquire cleared spectrum with exclusive rights have incentives to use it efficiently. The evolution of licensed cellular technology shows a continual progression of innovations to wring out more capacity. The problem arises when transmissions in one band manifest as interference in another band. The FCC is mandated to regulate transmitters, not receivers, even though poor-quality receivers effectively create interference. Without the incentives created by sharing, there may be insufficient pressure to deploy receivers that are robust to interference from transmissions in other bands, even when that would expand the overall utilization of the spectrum. The global positioning system industry was recently able to block LightSquared from deploying a new wholesale mobile broadband network because of such interference concerns (Federal Communications Commission, 2012c), showing that even when devices are unlicensed, allocations that do not contemplate sharing from the outset can be problematic.

Exclusive-use licenses today are almost always granted via auctions, which generate government revenues and, in theory, assign spectrum to those who value it most. A decision to clear frequencies for exclusive use is thus tantamount to a decision for auctions. In the current economic and technological environment, auctions create additional difficulties beyond those inherent in exclusive rights.

Auctions artificially favor large, incumbent providers. Auctions favor large, established companies, with prices for new spectrum licenses of decent size running into the multiple billions of dollars. This creates a “valley of death” that favors large incumbents and stifles opportunities for new entrants or nontraditional players (Marshall, 2012). At the same time, incumbents will often have the option to invest in infrastructure such as towers or backhaul that would achieve the same result as acquiring more spectrum, but will choose to purchase additional spectrum instead. New providers, on the other hand, cannot enter without access to spectrum.

Auctions artificially favor certain business models. Both sharing and exclusive use can create significant governmental revenues. Even purely unlicensed WiFi systems generate billions of dollars annually through taxes on equipment sales and fees for hot spot roaming services such as Boingo. The difference is that exclusive-use auctions ensure the largest up-front payment. Companies that make those payments then need to implement business models that recoup them. This typically involves maximizing airtime charges, tethering devices to service contracts, and potentially implementing restrictions on certain applications or services. Most of the FCC’s Open Internet regulations, which place limitations on such blocking behavior for wired broadband connections, do not apply to wireless broadband systems (Federal Communications Commission, 2010b).

Auctions create incentives for anti-competitive behavior. Large incumbents may purchase spectrum to warehouse for potential future needs or to prevent potential competitors from emerging (Benkler, 2012). Even if, by itself, the spectrum being auctioned is more valuable to a new entrant, the incumbent may be willing to pay more for it, thereby foreclosing competition.

Spectrum clearing efforts should continue where feasible, but they should not be the only path forward. New technological developments and a refined understanding of spectrum point to solutions that can increase the efficiency of wireless usage and avoid many of the potential pitfalls of exclusive-use licenses.

Why Sharing Pays

Existing spectrum policies were developed when greenfield spectrum was relatively available for new wireless applications. Now that that spectrum is, for the most part, extremely scarce, new policies are needed, just as planners in many urban regions have shifted their zoning policies to help urban cores thrive despite a lack of new land to develop. Fortunately, both technology and economists’ understanding of how communities can share resources effectively have also evolved tremendously.

Several strong reasons exist to include spectrum sharing in a comprehensive response to the wireless crunch.

Sharing increases efficiency and reduces waste. Based on pilot deployments and initial tests, TV white spaces are an example of how sharing can increase intensity of use. Television “guard band” spectrum is dark, despite growing demand, by government fiat. Unlicensed white space devices can fill in these spectrum holes by finding unused frequencies in their local area and transmitting at power levels that do not interfere with high-power television services. The fact that unlicensed devices must be robust to potential interference also increases spectrum efficiency. Low-quality unlicensed receivers cannot rely on the protection guarantees of an exclusive license and therefore will not be widely adopted.

Sharing could offer more, and more useful, dividends to governments. There is no doubt that spectrum auctions are potentially lucrative. However, focusing on short-term revenue curtails the overall benefits of spectrum to the government. The cost of relocating existing federal users may match or exceed the anticipated revenue from auctions. Furthermore, focusing on auction revenue ignores the financial benefits of alternative systems that are not represented by an up-front license payment. One estimate calculated these benefits as \$50 billion annually in the U.S. (Consumer Federation of America, 2011), and a comprehensive analysis in Europe concluded that shared access to spectrum generates welfare benefits exceeding several hundred billion dollars (Forge et al., 2012).

Sharing could generate recurring revenue. Under the plan outlined by PCAST, federal spectrum would be shared under various short- and medium-term, flexible licenses. These could provide a substantial source of recurring revenue to the government. Moreover, this allows the government to recapture gains as spectrum increases in value, just as local governments are able to adjust annual property taxes in response to rising land values. Under a system of single-user spectrum licenses that can be resold on a secondary market, on the other hand, the government does not have an easy way to reap dividends from increases in the value of spectrum.

Sharing ensures that spectrum is more accessible, to more people. The airwaves are a public asset, but for as long as wireless telecommunications technology has existed, public access to those airwaves has been limited. Fears of interference led to private enclosure of spectrum. However, anyone using a public park in a major city should recognize the benefits of making even extremely scarce and valuable assets open to the public. The rationales for such spaces are even stronger in the case of the spectrum, which now serves as a primary medium for expression and communication for billions of people worldwide. Spectrum sharing represents the best method for making more spectrum accessible to individuals, small businesses, and innovators.

Open and shared spectrum offers benefits for nearly all groups. More openly accessible spectrum makes privately licensed spectrum more valuable, just as a neighboring public park can increase the desirability of a plot of land, because everyone—including exclusive-use license holders—has access. Offloading of mobile traffic onto WiFi is just one example; in this way, mobile operators are able to shift lower-priority communications off of their licensed bands and reserve these frequencies for the more quality- and time-sensitive messages most suitable for exclusive-use frequencies. Shared spectrum also creates incentives for technological innovation that benefits all spectrum users, because many of the advances in sensing the surrounding environment and extracting information amid interference also improve performance in exclusive-use systems.

All this is not to say that shared spectrum systems are without their problems. The computational overhead involved in simultaneous use makes shared systems less useful for low-latency applications, although the surprising ability of unlicensed WiFi devices to support voice and even video effectively suggests this may be a limited concern. Many of the growth areas for mobile data, such as the Internet of Things (Thanki, 2013), are more delay-tolerant. Several other factors might tip the scales in favor of exclusivity, including cost and complexity of devices with the capability to operate in a shared environment; the propagation characteristics of the spectrum, with low frequencies traveling longer distances and penetrating walls and trees; and the need for certainty to justify investment in towers and other infrastructure. Setting shared access as a default will encourage advocates of exclusive-use allocations to advance these arguments and assess them on a case-by-case basis rather than merely assume clearing is the best approach.

The Feasibility of Spectrum Sharing

Wireless operators and trade organizations have complained that calls for spectrum sharing policies, such as the PCAST proposal, only serve to delay the process of clearing new spectrum to auction (CTIA, 2012; Information Technology and Innovation Foundation, 2012). They assert that sharing is unproven and represents a mere aspiration about future potential. These arguments, however, represent two fundamental misunderstandings.

First, a greater emphasis on spectrum sharing is not mutually exclusive with spectrum clearing. Where clearing and reauctioning is most feasible and advantageous, it can still be used. Also, there is a range of possibilities under a spectrum-sharing model. A spectrum access system for a particular band providing for very limited secondary and general authorized access would look quite similar to some existing exclusive-use allocations. And both approaches require incumbent spectrum holders to give up some of their exclusive control; sharing is by no means equivalent to the status quo.

Second, as described throughout this article, spectrum sharing is hardly a pipe dream. The key technologies and operational models are well proven. For example, the ability to shift frequencies to avoid interfering with incumbent systems was a core part of the 5 GHz standards for Unlicensed National Information Infrastructure (U-NII) devices established 15 years ago (Federal Communications Commission, 2013).

The vision of a fully "cognitive" radio, which could avoid interference purely through spectrum sensing and real-time frequency hopping or changes in modulation, remains the subject of research and development in the lab. However, the PCAST proposal is far more modest. It describes an architecture very similar to the one the FCC has developed over the past decade in its TV white spaces proceeding. Rigorously tested white space devices are coming to market today and require no exotic technology. They make use of cheap computational power and location-based databases, which are already features of today's smart phones and tablets. Even low-end mobile phones on the market today contain powerful computers with multiple radios and spectrum access modes.

The use of a database infrastructure greatly reduces the technical demands and reliability assumptions for mobile devices making flexible use of spectrum (Werbach, 2010). Such frequency

coordination, for example, is key to the recent FCC approval of secondary use of the 2360–2400 MHz band for indoor medical body area networks (Federal Communications Commission, 2012a). The FCC (2013) and NTIA (2013) are both exploring the technical feasibility of expanding U-NII rules (which include dynamic frequency selection) to the 5350–5470 MHz and 5850–5925 MHz bands, which would create a 750-MHz band of contiguous spectrum available for unlicensed operation; industry standards for high-speed wide-band technology that can take advantage of such large chunks of accessible spectrum are currently under development. And despite constant predictions of impending collapse, WiFi and other unlicensed systems have continued to operate in an environment of unrestricted sharing. Spectrum sharing is not a futuristic fantasy; it is a widespread reality today.

Even the major wireless carriers recognize the importance of sharing arrangements and the high costs of clearing new spectrum. For example, AT&T Mobility, T-Mobile, and Verizon Wireless recently announced a collaboration with the U.S. Department of Defense to test the possibility of sharing the 1755–1850 MHz band, using a combination of commercial low-power mobile broadband uplinks and government air combat training systems, aeronautical mobile telemetry, satellite command and control, and small unmanned aerial vehicles (Goldstein, 2013).

Similarly, the FCC's recent proposal to implement PCAST recommendations in the 3.5 GHz band highlights the fact that the primary obstacles to denser usage of spectrum in many bands are regulatory, not technological. The 3.5 GHz band currently supports satellite and radar operations that make geographically limited use of the spectrum band but preclude concurrent use for cellular networks. According to the proposal, a three-tier sharing system could be implemented in the near future in this band by utilizing existing small-cell devices and extending the TV white spaces database model. "We believe that current database technology can be used to achieve dynamic frequency assignment while mitigating interference between devices in the same frequency band," the FCC writes, although it also acknowledges that such a "Spectrum Access System as applied to the 3.5 GHz Band would implicate some novel issues," including "a new generation of this dynamic database technology" (Federal Communications Commission, 2012b, para. 58).

Major wireless equipment vendors also recognize that sharing arrangements are essential to meet growing demand. Qualcomm, which primarily sells technology powering licensed cellular systems, has, among other solutions, called for the creation of an Authorized Shared Access system (Qualcomm, 2012). Through ASA, commercial operators would be able enter into an exclusive sharing arrangement with incumbent users, particularly government agencies, on globally harmonized spectrum bands. This, along with the increasing availability and decreasing costs of small-cell devices such as femtocells, would allow for intense densification of wireless infrastructure and much more efficient use of higher-frequency spectrum bands, Qualcomm says.

New spectrum-sharing technologies will likely be developed as fast as or faster than new spectrum can be cleared, given the intense commercial and government interest in such technologies. Key innovations such as spread spectrum and orthogonal frequency division multiplexing were deployed on unlicensed systems before licensed cellular networks (Thanki, 2013). Next-generation cellular networks and new wireless networking standards in development, such as IEEE 802.11ac, will feature

advancements in smart antenna technology that will allow more data to be transmitted over the same frequency band.

Fundamentally, the dismissal of spectrum sharing reflects the conceptual difficulty of spectrum. Although most of us use mobile devices constantly, we still have a hard time coming to terms with the physics of wireless communication. Congested spectrum is not the same as an overused pasture, to use a common metaphor for what happens when communal resources are opened to general use. In the pasture, too many cows eating grass will literally destroy the ground, making it unusable. But radio spectrum works the same way as listening to a conversation in a loud room. No matter how noisy the environment, a conversation is not destroyed—it just becomes harder and harder to hear. In the same way, interference does not destroy the information carried via spectrum; signals just stack on top of one another, increasing the effort required to extract communications (Computer Science and Telecommunications Board, 2011).

Technologies of spectrum sharing are becoming more sophisticated in both licensed and unlicensed systems. The best approach to use in any case can be debated, but sharing should not be written off at the outset as a technological fantasy.

Conclusion

Spectrum policy should refocus on the goal of maximizing the volume and value of usable capacity. Sharing mechanisms must be an important part of that effort. Another way to frame the imperative is that spectrum policy should make a commitment to *users* of spectrum rather than merely to spectrum *holders*. Whether the policy goal is to promote private investment or citizen empowerment, greater use of potential wireless capacity is the ultimate objective. Changes in who controls frequencies are a means to that end.

Approaches that emphasize spectrum clearing to the exclusion of spectrum sharing will, in effect, leave capacity on the table. Furthermore, an environment of predominately exclusive rights will be less conducive to new forms of competition, out-of-the-box innovation, community engagement, and diversity of applications. The history of communications media is rife with examples in which openness was sacrificed for economic feasibility. In the 21st-century wireless environment, such a trade-off is unnecessary, but only with the right policy choices.

The U.S. government is turning over every possible stone to identify, clear, and reallocate underutilized spectrum bands. However, given the more intensive uses of those bands and the lengthy time lines of recent reallocations, there is no guarantee that substantial amounts of new spectrum will go to auction anytime soon. Ultimately, regulators will have to make decisions on how to move toward more effective spectrum use in the face of uncertainty—both on whether new spectrum can realistically be cleared in the near future and how quickly proposed sharing mechanisms can be developed and implemented. If history is a guide, those decisions will shape wireless communication for decades to come.

Relying more on spectrum sharing will open up new opportunities for investment and innovation in wireless systems and offer more flexibility in the face of changing technology and societal demands. Such an approach holds the best hope for turning the wireless crunch into a spectrum opportunity.

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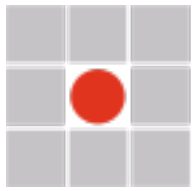
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Public Knowledge

**Breaking the Logjam:
Creating Sustainable Spectrum Access Through
Federal Secondary Markets**

Harold Feld

Dr. Gregory Rose

I. INTRODUCTION

It has become trite to observe that the use of wireless services, both fixed and mobile, has grown exponentially in the last two decades. But policies governing access to spectrum have failed to keep pace. The 1990s saw two important changes in spectrum allocation that supported the phenomenal growth of wireless networks of all sizes, ranging from national networks supporting tens of millions of subscribers with mobile handsets to extremely low-power networks permitting those subscribers to use hands-free Bluetooth devices. During that decade, Congress and the FCC embraced a policy of distributing exclusive rights of access through license auctions,¹ while simultaneously permitting low-power “unlicensed” spectrum access for properly certified devices.² Over the course of two decades, this combination of spectrum allocation approaches produced the existing environment in which licensed and unlicensed providers offer complimentary – and occasionally competing – products for an increasing variety of services.

Recent developments in technology make possible a third way to allocate spectrum, which combines features of certain kinds of unlicensed spectrum with the higher power and interference protection associated with licensed spectrum distributed by auction. By combining the technical rules developed by the FCC to allow unlicensed access on unused broadcast television channels (the “TV white spaces”) with the ability to dynamically reassign spectrum from one user to another as well as the ability to conduct real-time auctions, the federal government can dramatically increase the availability of spectrum access through real-time secondary markets in spectrum. As discussed below, this system would not require existing federal users to migrate or require the development of new service rules for each band of spectrum, vastly shortening the time it takes to make federal spectrum available for non-federal use. At the same time, using real-time auctions as a means to allocate spectrum to prevent congestion, rather than allowing open access on equal terms as is traditional in unlicensed access, would permit higher power levels and greater interference protection than is permissible in unlicensed allocation.

Real-time auctioning would also permit the federal government to directly recoup the value of the use of public assets, while balancing with this the need to make spectrum available for non-revenue generating purposes. One of the attractions of clearing federal spectrum and auctioning exclusive, geographic-based licenses is that such an approach has the potential to raise substantial revenue the federal government. Auctions of desirable spectrum routinely raise billions of dollars. But this advantage of raising revenue comes at a high social cost. The high cost of spectrum licenses forecloses all but the most well capitalized bidders from winning licenses. This has a significant impact both on the structure of the mobile wireless industry and on the use of wireless access for services other than commercial mobile radio service (CMRS) and broadband. Industrial users have complained that it has become impossible to win licenses in recent auctions in markets where CMRS providers anticipate significant future demand for high-

¹ See Omnibus Budget Reconciliation Act of 1993, Pub. L. No. 103-66, § 6002; Balanced Budget Act of 1997, Pub. L. No. 105-33, §§ 3002-04.

² See Kenneth R. Carter, Ahmed Lauhjoui, and Neal McNiel, Unlicensed and Unshackled, OSP Working Paper #39 (2003), available at http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-234741A1.pdf.

bandwidth applications.³ Many CMRS providers and potential new entrants also complain that auctions by their very nature favor the largest providers because these providers have a superior ability to attract capital and to extract revenue from the licenses after the auction. This impedes the development of robust competition. The need to raise substantial amounts of revenue immediately to recoup the cost of licenses also discourages spectrum auction winners from experimenting with new business models.

Dynamic secondary markets for federal spectrum provide a means of addressing needs for spectrum access that the current choices – licensed and unlicensed access – do not meet. The rise of secondary markets in commercial spectrum since the Federal Communications Commission (FCC) reformed the secondary market rules in 2004, the recent announcement by Harbinger Capital Partners that it will invest billions of dollars to create a nationwide 4G LTE network, which will lease capacity to retail providers,⁴ and announcements by Verizon and Clearwire indicating their willingness to lease access to their spectrum to rural providers,⁵ all demonstrate the demand for leased-based, rather than auction-based, allocation of high-power spectrum with protection from interference. As an additional benefit, the development of tools to manage dynamic federal spectrum secondary markets would likely further stimulate existing commercial secondary markets by facilitating creation of the “private commons” model envisioned by the FCC when it created the existing secondary markets rules in 2004.⁶

We stress that none of this makes federal secondary markets a replacement for either exclusive licensing or for unlicensed access. Rather, we believe that dynamic federal secondary markets would provide an important new means of allocation to address unmet needs. This approach should be used in combination with proposals to increase spectrum access via opportunistic sharing and further auctions of exclusive licenses. Indeed, we anticipate that existing users of exclusive licenses and of unlicensed access will likewise benefit from this new option for spectrum access. AT&T’s recent decision to create WiFi hotspots in high-demand markets such as New York to supplement its existing CMRS network⁷ provides one example of how even a carrier dependent on licensed spectrum can benefit from the availability of alternate means of spectrum access.

II. THE TRADITIONAL WAYS TO ALLOCATE SPECTRUM ACCESS CANNOT KEEP PACE WITH DEMAND

The two existing systems for allocating spectrum access – auctioning exclusive licenses and open unlicensed spectrum – can no longer keep pace with growing demand. While one may debate whether or not we face a genuine “spectrum crisis,” the FCC’s massive research effort as

³ See *Reply Comments of the American Petroleum Institute, National Broadband Plan Public Notice #6*, Docket No. 09-47, 09-51, 09-137, (filed November 13, 2009).

⁴ Peter B. de Selding, “SkyTerra Buyer Commits to Multibillion-Dollar Ground Network,” Space News (March 29, 2010). Available at: http://www.spacenews.com/satellite_telecom/100329-skyterra-buyer-commits-multibillion-dollar-ground-network.html.

⁵ Maurgeritte Reardon, “Rethinking the Wireless Spectrum Crisis,” Cnet.com (May 25, 2010). Available at: http://news.cnet.com/8301-30686_3-20005831-266.html

⁶ *Promoting Efficient Use of Spectrum Through The Elimination of Barriers to Secondary Markets, Second Report and Order, Order on Reconsideration, and Further Notice of Proposed Rulemaking*, Docket No. 00-230, (2004). Available at: http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-04-167A1.pdf

⁷ Maurgeritte Reardon, “AT&T Offers Free WiFi in New York City,” CNN.Com, May 25, 2010, available at: <http://www.cnn.com/2010/TECH/mobile/05/25/att.free.wifi.nyc.cnet/?hpt=T3>

part of the National Broadband Plan generated a clear consensus that demand for wireless capacity – for commercial mobile services, fixed services, and public safety – will rapidly outstrip the current allocations of licensed and unlicensed spectrum capacity. In response, the FCC proposed finding 500 MHz of spectrum for auction while expanding unlicensed spectrum access through completion of the TV “white spaces” proceeding, encouraging the development of new technologies to promote shared use, and allocating a band of spectrum for unlicensed use, unencumbered by licensees requiring interference protection.⁸

Each of these proposals, however, faces considerable political, economic and technical objections. Those favoring the creation of more licensed spectrum face the practical problem of identifying where they would find more spectrum for auction – particularly paired spectrum in the frequency ranges prized by cellular providers. Those advocating an emphasis on unlicensed access and other forms of shared spectrum face resistance from federal deficit hawks hoping for billions in auction revenues. More importantly, none of these proposals addresses the underlying problem that the demand for wireless capacity will continue to grow and will, ultimately, exceed the capacity of a short term injection of licensed or unlicensed capacity.

In short, our current system of allocating spectrum access is ***no longer sustainable***. Just as the shift to auctions and unlicensed allocation made possible the phenomenal growth of wireless services over the last 15 years, federal policy must find a new, sustainable system of spectrum allocation to meet growing demand from all sectors of society. Three developments in the last five years point toward a new spectrum allocation mechanism that can supplement existing licensed and unlicensed allocations.

First, several regulatory actions by the FCC permitting licensees to lease their spectrum through approved “secondary market” transactions have created an expanding secondary market in spectrum access. Spectrum Bridge, a major broker of spectrum leases, reported to the FCC that it “has successfully completed tens of millions of dollars of secondary market transactions in 2009 alone.”⁹ In March, Harbinger Capital Partners announced plans to invest billions in a 4G network that would offer to lease spectrum wholesale.¹⁰

Second, the FCC’s TV white spaces proceeding has demonstrated the viability of a new generation of flexible “smart radios,” able to avoid interfering with existing licensees. Under the proposed rules, fixed devices for point-to-point transmission and lower-power mobile devices would operate on empty channels in the existing broadcast bands. These devices communicate their position to a central database containing information on existing licensed services in the geographic area entitled to interference protection. The database then provides operating instructions to the devices, informing the devices on which channels they may operate in, and at what power. Unlike traditional unlicensed allocations, which operate under the same rules and power levels nationally, the TV white space devices transmit on frequencies and at power levels determined by applying FCC rules to the spectrum environment in a given location. This permits

⁸ Connecting America: The National Broadband Plan, Chapter 5 (2010). Available at: <http://download.broadband.gov/plan/national-broadband-plan-chapter-5-spectrum.pdf>

⁹ Comments of Spectrum Bridge, Inc., GN Docket Nos. 09-157, 09-51 (filed September 30, 2009).

¹⁰ “Hedge Fund Harbinger Capital Plans 4G Network,” (March 30, 2010). Available at: <http://www.marketfolly.com/2010/03/hedge-fund-harbinger-capital-plans-4g.html>

the unlicensed devices to co-exist with the existing licensed services without causing harmful interference.

Third, the FCC has approved the concept of dynamic frequency assignment as sufficiently reliable to satisfy the needs of public safety. Proposals for public safety use for the 700 MHz band returned by broadcasters as part of the conversion from analog to digital television broadcasting have relied on the ability to dynamically reassign spectrum access from commercial users to public safety users instantly on an as needed basis in the event of an emergency.

Taking these three developments together allows the federal government to create a new approach to spectrum allocation – dynamic federal spectrum secondary markets. Consider a system where the federal government enters all known federal users in a database similar to the white spaces database. As with the existing broadcast band, this “federal band” would have a broadly dispersed “Swiss cheese” distribution of actual transmitters and receivers. Some bands would be entirely off limits on a nationwide basis, but others would be unused in specific geographic areas – although they might be subject to immediate dynamic reallocation back to federal users on an as needed basis.

The devices – and the users of such devices – linked to the database would not need to know the specific frequencies or why some frequencies are available and others are not. Rather, those needing spectrum access would simply inform the database of their overall capacity need, and the database would respond with a specific set of instructions to the device.

While such a system could permit unlicensed access for free, requiring the devices to purchase access through real-time auctions has a number of advantages. First and foremost, it recognizes the political reality that management of federal spectrum includes raising federal revenue. While it is difficult to predict precisely how much revenue the federal government could raise over time through federal spectrum secondary markets, our preliminary economic analysis suggests that, under certain conditions, the federal government could raise more money over time by leasing spectrum than through a one-time auction of the sort used to distribute standard licenses. The revenue generated by the auctions could also be used to maintain the network and database – either directly by the federal government or through a federal contractor. Finally, real-time auctioning also creates a mechanism to resolve potential interference issues between users through the simple expedient of market transactions rather than through contention-based protocols or spectrum etiquettes.

The technology to develop such a federal secondary market system already exists – at least at the proof of concept stage. Indeed, Google investigated the possibility of building such a network when it participated in the 700 MHz auction in 2007. Such a system would not *displace* either auction or unlicensed access. To the contrary, any bands of federal spectrum subsequently allocated for auction or for unlicensed use could simply be removed from the federal secondary markets database. This approach allows spectrum desperately needed to address a variety of industrial needs to come to market quickly, without the delay and expense of migrating existing federal users to new spectrum. In particular, it provides spectrum access for non-cellular services such as wireless backhaul, machine-to-machine communication, and industrial users that have reported increasing difficulty competing at auction with mobile carriers. The secondary market model also addresses concerns that the largest cellular carriers will be able to dominate future

spectrum auctions as a result of their superior capitalization and greater ability to extract revenue from licenses post-auction.

Finally, critics of spectrum auctions have raised concerns that incumbent users may bid on spectrum licenses for the purposes of keeping spectrum out of the hands of competitors. These critics point to the failure of some licensees to build out systems despite aggressive bidding as evidence that these incumbents have no genuine interest in the licenses. Incumbents and others favoring distribution by auction have disputed that licensees hoard spectrum. They respond that many reasons exist why incumbents might bid on licenses but take years to begin build out. Changes in the technology or business environment might upset previous business plans, for example. Whether by accident or design, however, the problem of licensees failing to build out systems, and thus preventing any use of the spectrum in question, has become sufficiently urgent that the FCC has addressed it in several recent proceedings. Spectrum hoarding concerns have also arisen in commercial secondary markets, as evidenced by the FCC's decision to limit the amount of spectrum made available to SkyTerra.

Without addressing the underlying merits of these concerns, we note that using dynamic real-time auctions of federal spectrum would prevent hoarding and improve competitive access. The proposed federal secondary markets network would lease spectrum in real-time. When a provider was not actively using the spectrum, it would become available. By leasing on the basis of throughput capacity rather than on the basis of frequency bands would make it extremely difficult, if not impossible, to lease "all" of the spectrum solely for anticompetitive purposes. Furthermore, holding the capacity in real-time against all comers with genuine need would prove an expensive competition, as it would require holding the winning bid in multiple repeating auctions.

II. WHAT IS "FEDERAL SPECTRUM?"

Before we can discuss how to implement such a system, we must first explain precisely what we mean by "federal spectrum." By law, the Federal Communications Commission controls all access to the airwaves by non-federal users. The Communications Act assigns authority to manage use by federal users to the President. The President delegated that power to the Assistant Secretary of Commerce for the National Telecommunications Information Administration (NTIA), a delegation subsequently confirmed and modified by statute. Over the years, certain frequency bands have been allocated to the federal government.

As a statutory matter, there is no such thing as "federal spectrum" distinct from "commercial" spectrum. Bands may be allocated "on a primary basis for Federal Government use," 47 U.S.C. § 927(b), but this does not restrict the FCC's ability to authorize additional, non-interfering uses. Under the Communications Act, and as modified in the National Telecommunications and Information Agency Organization Act (NTIA Act), the FCC grants *licenses* to non-federal users. 47 U.S.C. §301. By contrast, the Communications Act assigns the power to authorize use of spectrum for "government owned stations" (*i.e.* federal users) to the President. 47 U.S.C. §305(a). In 1992, Congress ratified delegation of this authority to the Assistant Secretary of the NTIA, 47 U.S.C. § 902(b). The Commission may, therefore, authorize

non-interfering use of “federal spectrum” under its own authority, and may even authorize interfering uses subject to certain conditions. *See* 47 U.S.C. § 323, § 903(e).

Congress, however, has expressed a desire for the FCC to coordinate with the NTIA rather than proceed by unilateral action. Indeed, 47 U.S.C. § 922 requires the Chairman of the FCC and the Assistant Secretary to meet “at least biannually” to discuss “actions necessary to promote the efficient use of the spectrum, including spectrum management techniques to promote shared use of the spectrum that does not cause harmful interference as a means of increasing commercial access.” § 922(4). Congress further demonstrated a desire to expand the mixed use of frequencies primarily allocated for federal use through coordination between the Department of Commerce and the Commission by authorizing the Secretary of Commerce to, “at any time allow frequencies allocated on a primary basis for Federal Government use to be used by non-Federal licensees on a mixed-use basis for the purpose of facilitating the prompt implementation of new technologies or services or for other purposes.” §927(2). Congress explicitly instructed the NTIA to modify its regulations to facilitate the “prompt and impartial consideration of such requests,” §903(b)(5), subject to rules and procedures developed by the FCC. §903(e).¹¹

A. Role of the NTIA and Other Federal Agencies In Management of Federal Spectrum.

Although the Communications Act centralizes authority for federal assignment in the President, delegated to the Assistant Secretary for the NTIA, management of federal spectrum requires a complex balance between the current needs of federal agencies, and their possible future needs. Further, although the NTIA has a general coordination responsibility, usually exercised by its hosting the Interdepartmental Radio Advisory Committee (IRAC), the NTIA does not have direct authority over the agencies it authorizes to use particular allocated frequencies. To make matters more complicated, agencies are not entirely forthcoming with the NTIA with regard to the nature of their needs. Often, agencies cite an inability to predict future needs with precision, or security considerations, or both. This makes it difficult for the NTIA to provide the public with a complete picture of federal spectrum use or to estimate future federal spectrum need.

This lack of transparency in federal use creates enormous frustration for those trying to expand non-federal access to spectrum allocated on a primary basis to federal users. As a result, non-federal users often cite a culture of obstruction, bureaucratic inertia, and a refusal to adopt

¹¹ Although Section 903(e) states that an entity must obtain a “license” as a precondition of operating a “radio station utilizing a frequency authorized for the use of government stations,” the Commission has previously found that the term “license” is sufficiently broad so as to include operation of properly certified Part 15 “unlicensed” devices pursuant to rules and limitations adopted by the Commission. *See* In re Revision of Part 15 of the Commission’s Rules Regarding Ultra-Wideband Transmission Systems, Second Report and Order and Second Memorandum Opinion and Order, 19 F.C.C.R. 24,558 at ¶¶ 75–76. (2004) *See also* 47 U.S.C. § 3(42) (2000) (defining “license”). Likewise, the Administrative Procedures Act defines license as “the whole or a part of an agency permit, certificate, approval, registration, charter, membership, statutory exemption or other form of permission.” 5 U.S.C. § 551(8) (2000).

more efficient technologies as evidence that vast swaths of federal spectrum could be cleared and made available for non-federal use.

But the truth is not so simple. Federal agencies are properly security conscious and risk averse in the areas of national security and public safety. As a nation, we want the military defense radar to look like empty, unused space. Creating a regime that too easily allows hostile powers or terrorists to “fill in the lines” and identify national security assets does not serve the national interest.

Nor does it serve the national interest to freeze federal use of spectrum at existing levels. In assessing the need for federal spectrum and the ability of agencies to operate more efficiently, the NTIA and other federal agencies must remain mindful that demand for wireless capacity is increasing among federal agencies for the same reason it is increasing for non-federal users. Requiring the federal government to contract for future spectrum use after clearing and auctioning spectrum would be more expensive and less efficient in the long run. Moreover, it would discourage federal agencies from being genuinely innovative in spectrum use, since any increased reliance on wireless would require that agencies expand their budgets for spectrum access fees.

At the same time, however, spectrum access has grown too important simply to trust that federal agencies accurately report their needs to the NTIA, and that the NTIA, in turn, accurately assesses these needs in coordinating allocations. Even assuming good faith and complete information, shutting non-federal interests out of the decisions on federal spectrum access forecloses the NTIA and federal agencies from the benefit of alternative perspectives. A lack of transparency also fosters an insular and defensive approach to spectrum management, where federal agencies seek to preserve their spectrum from private sector “poaching.” This perspective is only reinforced by the current system, where honesty about future spectrum needs and efficiency in existing use is rewarded by clearing and transferring spectrum to the private sector. For these reasons, Congress explicitly instructed the NTIA to take steps to increase transparency in federal decisions on spectrum management. 47 U.S.C. §903(a)-(b). Although the NTIA has complied with the minimum obligations under the statute, it could, and should, do more to enhance transparency in federal spectrum management without compromising national security.

B. How The Law Plays Out To Create The Current Landscape

“Federal spectrum” therefore proves something of an elusive animal, which has consistently served to muddy the debate. On the one hand, we speak of “federal spectrum” as a unitary entity managed by the NTIA. We conceive of the bands assigned to specific agencies in the same way we think of the FCC assigning commercial spectrum by frequency band for specific purposes. Thus, in commercial spectrum, we can speak of “the TV broadcast bands” and understand the needs of that service. Part 74 of the Commission’s rules explains what full power and low power television broadcasters do, how the FCC assigns them licenses, the permissible frequencies and power, and so forth. The band may be “Swiss cheese” in terms of geographic locations where the frequencies are not assigned, but – like Swiss cheese – its basic character is understood.

Federal spectrum creates a far more challenging problem in that it is assigned by agency, not service. In theory, agencies apply through the procedures outlined in the NTIA's voluminous "Red Book" and provide specific information on projected use. In practice, agencies with broad duties and national jurisdiction often receive broadly defined national grants of authority for use for a wide variety of purposes. One cannot speak of "FAA spectrum" in the same way that one speaks of "broadcast spectrum." Further, the same spectrum bands might be allocated to different agencies on a geographic basis for very different purposes.

While the NTIA has improved its efforts to provide more specific information in recent years, it remains difficult to determine how agencies actually use the spectrum allocated to them. For example, the most comprehensive analysis of federal spectrum use remains the *Federal Strategic Spectrum Plan*, published in March 2008 as the culmination of President Bush's spectrum planning initiative begun in 2004.¹² While providing a general overview of use by agency, it is virtually impossible to determine the precise characteristics and of any given spectrum band – or even whether a band listed as used by an agency is shared with non-federal users. By contrast, for non-federal users, it is possible to find in the FCC regulations a precise description of each service.

Federal agencies maintain that because of the lack of specific information, any effort to reallocate spectrum to clear and auction bands for commercial use, or to permit shared use on an unlicensed basis, cannot be done. It is simply too messy and too uncertain to try to clear bands because displaced federal users may have no place to go. It is not possible to allow unlicensed access at low power because the various agencies using the same bands nationally use them for very different purposes, making it impossible to authorize useful power levels on a national basis for unlicensed devices.

At the same time, however, the fact that so many different users can operate simultaneously in these bands for so many variable uses suggests that the objections to permitting greater non-federal access on a shared basis can be overcome. After all, all of these federal agencies somehow manage to use the frequency bands in question without interfering with each other. The purported lack of certainty that would make opportunistic sharing impossible for unlicensed spectrum does not seem to prevent federal agencies from accomplishing the same opportunistic sharing for themselves via the mechanism of the IRAC and existing federal allocation. One must conclude either that federal agencies have greater information and coordination than they care to admit, or that barriers to mixed use (or relocation of federal users in already occupied bands to clear spectrum for national auction) can be overcome with somewhat less difficulty than suggested.

Finally, we must recognize that the current stalemate over how to enhance non-federal access to spectrum allocated primarily for federal use results from competing policy goals as much as from uncertainty or intransigence on the part of federal users. Although the Federal Communications Commission is prohibited by law from considering how to maximize federal revenue through spectrum management, the NTIA is required by law to consider precisely this question, although not as the sole determining factor. This creates an unfortunate conflict between maximizing the broadly defined public interest and maximizing auction revenue. This

¹² Available at <http://www.ntia.doc.gov/reports/2008/FederalStrategicSpectrumPlan2008.pdf>.

conflict is further sharpened by sharp disagreements among industry stakeholders and public interest advocates for financial and ideological reasons. Traditionally, carriers have favored maximizing “clear and auction” policies, supported by advocates who believe that creating property interests in licenses will enhance efficiency and maximize public welfare (“the property school”). On the other hand, the technology sector has favored increasing unlicensed access, supported by advocates who believe that maximizing universal access to spectrum without the need for licensed intermediaries will enhance efficiency and maximize public welfare.

The result of this political and economic conflict of interests, layered on top of a legal structure that makes coherent analysis of federal spectrum difficult to start with, has been utter paralysis in the management of federal spectrum for the last several years. Although both supporters of licensing and supporters of unlicensed generally agree at this point that both allocation systems have value, each camp insists that its needs are paramount and should be met first. More importantly, each camp recognizes the very real likelihood that allocating spectrum to one camp would automatically preclude allocating it to the other – and who knows when any further spectrum would be allocated? As a result, to paraphrase a well worn cliché about the public airwaves in the form of weather, “while everyone talks about the spectrum shortage, nobody does anything about it.”

III. DYNAMIC AUCTIONS PROVIDE A WAY FORWARD

In recent years, the problems cited as obstacles to mixed federal and non-federal use – the uncertainty of the spectrum environment, the “Swiss cheese” nature of bands, the inability to offer a sufficiently large contiguous band necessary to support high-bandwidth traffic, the need of federal agencies to access “empty” spectrum immediately, and the need to maintain national security around certain types of spectrum use – have all been solved in other environments. All that remains is to put the pieces together. While this could be done on a dynamic basis for unlicensed spectrum, as proposed by the FCC in the TV White Spaces proceeding, layering real-time dynamic auctions has certain advantages. While charging for spectrum use does, as argued by unlicensed advocates, limit who can use the spectrum, imposes an added layer of complexity on the technology, and requires a centralized architecture at some level to facilitate billing and revenue collection, real-time auctions address the need for federal revenue and provide those willing to pay for it with a level of interference protection unavailable to users of unlicensed spectrum.

A. Designing The Federal Spectrum Secondary Market Network

The design for a secondary market system essentially parallels the design approved by the FCC for unlicensed opportunistic use of the broadcast television white spaces. That design works as follows: a central database contains information on all licensed transmitters. Devices contacting the database are given a set of rules for transmission based on their geographic location and the varying criteria for protection assigned by the Commission. Further, even where a device may operate on a particular 6 MHz channel, the power at which it can operate will depend on whether the open 6 MHz channel is adjacent to an occupied 6 MHz channel.

This provides a basic model for a federal system. First, create a database of federal bands and the uses of these bands by geographic location. Federal agencies using the same spectrum bands for different purposes in different geographic locations can be easily accommodated and avoided. Power levels for available frequency bands can be set based on protecting neighboring services given the specific characteristics of local services. As with the TV White Spaces database, federal users can update the database at any time. Thus, as federal spectrum use changes, the database makes new spectrum available or limits access accordingly.

For federal users that may require immediate access to spectrum, the system would borrow technology similar to that approved in concept by the FCC for the public/private partnership in the D Block, itself based on existing technology for sharing licensed spectrum among licensed users. Under the original D Block proposal, a private entity holds a national 10 MHz license adjacent to the 12 MHz national license held by the Public Safety Spectrum Trust (PSST). The D Block holder would have access to the PSST spectrum, and would lease the spectrum to others. When public safety operators needed access to the spectrum, they would be able to access the spectrum immediately, including the privately held D block spectrum. This would give public safety users access to 22 MHz of spectrum at need, while allowing the D Block holder to lease up to 22 MHz subject to immediate access by public safety users. Although the failure of the D Block auction prevented implementation of the system, the public safety community, the FCC, and private investors proposing the system all agreed that current (for 2007) technology would meet the necessary technical needs.

Those seeking access to federal spectrum between 30 MHz and 3000 GHz would not access the spectrum based on spectrum band, or power. Rather, parties would query the database for throughput capacity, specifying mobile, fixed, point-to-point, or mesh. The database would determine whether the request could or could not be met. Finding a solution, the database would provide instructions to the transmitting devices. As additional, non-federal users seek access, the network would conduct real-time auctions among the competing users.

Such a system would likely satisfy some uses -- such as wireless backhaul, machine-to-machine, low-bandwidth mobile uses, and other uses not readily accommodated by existing architectures -- more easily than others. But the secondary market system could permit multiple competing uses and modulation technologies, providing would be users with considerable flexibility. Conflicts between users for incompatible uses within the same geographic location would be resolved by auctioning in real-time rather than by permanent service rules. It would require only that the database have the capacity to recognize not only how a particular modulation technology impacts federal users, but how multiple systems impact each other. Indeed, a sophisticated system -- but one still within existing design capabilities -- would offer to parties options that minimize interference among competing systems and so reduce the need to out-bid competing users.

This might impose some limits initially, such as limiting would-be users to pre-approved modulation schemes. But the vast number of well-understood modulation schemes already available ensures that limiting users to a pre-approved menu of options should still provide for a wide range of applications made available through the system.

IV. ADDRESSING TRADITIONAL OBJECTIONS TO FEDERAL SECONDARY MARKETS

Objections to secondary markets in federal spectrum generally fall into two distinct categories: technical objections and political and economic objections. The technical objections largely focus on whether or not the system described could be built and whether it could adequately protect federal users. As discussed above, the basic technical problems for each element of the proposed system have already been solved. The more substantive objections that remain are more political/economic in nature. These objections include the problem of compiling a sufficiently comprehensive database of federal spectrum users, inducing federal users to report their use accurately and dynamically, and whether there exists a sufficient market to justify development of the network in the first place. We note that while many of these objections (e.g., difficulty in protecting federal users) are often posed as technical objections, they are more accurately described as political and economic objections since they flow from the need to address federal user behavior rather than from the inability of existing technology to handle a complex spectrum environment in a dynamic manner.

A. The Proposal Requires No New Breakthroughs In Technology

Implementing the proposed network does not require speculative technology. All of the elements of the proposed system either already exist, or have been approved in concept by the FCC for use in commercial spectrum. In 2007, Google sought permission to implement a similar system of real-time auctions for access when it bid on the C Block in the 700 MHz auction.¹³ Spectrum Bridge operates a TV White Spaces database for experimental licenses, and nine parties submitted proposals to operate the national TV white spaces database.¹⁴ As part of the National Broadband Plan, the FCC announced that it would require all 700 MHz licensees to provide public safety entities with access to spectrum in an emergency on an as needed basis.¹⁵

Were this system implemented, it would be necessary to draw up rules to protect services. This would require an honest examination of the likelihood of interference by users with existing federal systems. For example, certain bands are used primarily for naval operations, limiting the need to protect coastal areas (including the Great Lakes). Bands involving transmission of strong signals by federal users may be robust enough to allow sharing by non-federal users using weaker signals. Bands used for weather radar may be usable on the ground without creating undue interference. Further, even where bands are available, the database would need to instruct transmitters on permissible power levels and out-of-band emissions (OOBE) to shield operations (both federal and non-federal) in neighboring bands.

Certainly these problems are complex. But they have all been solved in other spectrum environments. Indeed, the Defense Advanced Research Agency (DARPA), has developed technology to perform this precise function for U.S. military deployment abroad, so that U.S. troops can have adequate access to spectrum in any theater of operation, while coordinating with

¹³ Letter of Rick Whitt, Docket No. 06-150 (May 21, 2007) Available at: <http://fjallfoss.fcc.gov/ecfs/document/view?id=6519412640>

¹⁴ Order, Unlicensed Operation In the TV Bands, Docket No. 04-186 (February 1, 2010). Available at: http://hraunfoss.fcc.gov/edocs_public/attachmatch/DA-10-215A1.pdf

¹⁵ Connecting America: The National Broadband Plan, Chapter 5 (2010). Available at: <http://download.broadband.gov/plan/national-broadband-plan-chapter-5-spectrum.pdf>

allied troops or an allied host country. Nothing suggests that the domestic U.S. spectrum environment is so much more complicated that the same technology could not work here.¹⁶

Creating the proposed secondary market network for federal spectrum, therefore, requires no radical technological breakthroughs. It merely requires combining elements of existing technologies into a single system. While this does, of course, require overcoming challenges that invariably arise in the course of implementation, this is true of any new network. Such a system could be designed today and construction begun. But the fact that such a system is possible as a matter of engineering does not resolve all objections.

B. Problems With Federal Inputs

As noted above, the current regulatory regime creates an unfortunate incentive for federal agencies to resist transparency in federal spectrum use. Indeed, efforts to pass pending bills designed to create a database of the federal spectrum inventory have been met with resistance not from industry or public interest advocates – all of whom favor passage – but from Defense Department officials ostensibly concerned with national security.¹⁷

How, then, to construct an accurate database so that the operation of federal secondary markets can move forward? First, it is important to address legitimate concerns by federal users with regard to national security and their ability to access needed spectrum. At the same time, it will also be necessary to provide proper incentive for federal users to participate and update the system as needed.

From a national security standpoint, the key lies in the fact that no one without suitable security clearance needs to have access to the contents of the database. The database provides a set of instructions to a transmitter based on stated capacity needs, not based on a request for particular frequencies. The transmitting device (and its user) do not need to know why particular frequencies are unavailable. Indeed, information as to the frequencies on which the user's devices are transmitting can even be hidden from the user. All the user needs to know is that the device is operating in accordance with the user's stated needs. This not only protects bands off limits for security reasons, it prevents parties from "filling in the blanks" and guessing the uses of prohibited spectrum through knowing on what frequencies certain top secret operations must take place.

The next problem is somewhat more difficult. How can agencies be compelled to provide accurate information for the database? Here, it seems that the best approach is to rely on self-interest. A failure to provide information means a channel is considered open and ready for use. Agencies concerned with interference will apply proactively. Agencies that suffer interference can add their information to the database in real-time. As noted above, a critical aspect of the design will include a means by which federal agencies can signal they require immediate access to "open" spectrum. Accordingly, an agency's failure to include information in the database would not preclude it from using assigned frequencies.

¹⁶ Benjamin Lennett, "Good Enough For the Pentagon: The Feasibility of "Smart Radio" Technology in the TV White Spaces," New America Foundation (2008). Available at: http://www.newamerica.net/files/nafmigration/Good_Enough_for_the_Pentagon.pdf.

¹⁷ Matthew Lasar, "Congress Wants Big NatSec Exemptions for Spectrum Inventory," Ars Technica. Available at: <http://arstechnica.com/tech-policy/news/2010/03/congress-wants-big-natsec-exemptions-for-spectrum-inventory.ars>

More difficult is the problem of agencies claiming more spectrum than they actually use, or failing to clear discontinued uses. Such “false positives” in the database may happen as a result of honest error or from strategic behavior by agencies that do not trust in the reliability of the secondary markets network. Here, the ability to assign on a dynamic basis may prove particularly useful when combined with sensing technology. The secondary markets network can incorporate the ability to systemically “audit” uses and confirm that a band is actually in active use. Again, we stress that federal users will be able to exclude non-federal users from particular bands and access the bands themselves in real-time. Indeed, the default setting for many bands may be that they are unused and available for leasing, subject to an interrupt signal from the assigned federal user.

It is not hard to imagine tweaks to the system that would allow it to learn with regard to the surrounding spectrum environment, either by improved spectrum sensing or by detecting patterns in demand over time. It is also possible to begin the system with an incomplete inventory and add more “channels” as the rules for additional bands are formulated. Further, we note that similar objections have been raised, and solutions proposed, in the FCC’s TV White Spaces proceeding. These solutions should be applicable to federal spectrum.

C. The Economic Value Of Federal Secondary Markets

Assuming that it is possible to implement such a system, would it prove economically worthwhile? This requires weighing the competing aspects of federal spectrum policy discussed in Section II. Would such a system raise revenue? Is there a demand for secondary market spectrum? Would it promote access to spectrum in a manner that helps to alleviate the pending spectrum shortage, or would focusing on designating bands for auction or for unlicensed opportunistic sharing better serve federal policy? We examine each of these in turn.

1. Would the Federal Government Realize Significant Revenue From Secondary Markets?

Any entrepreneur examining whether to bring a product to market must answer the same question: is it worth it? Federal spectrum policy, while not focused solely on maximizing revenue, does take the ability to raise revenue into consideration when considering whether to make federal spectrum available. At any rate, the implementation of the system must at least pay for itself. Accordingly, we examine whether a market for federal spectrum on a dynamic lease basis, or even on a non-dynamic lease basis, exists.

Secondary Markets in Spectrum have expanded tremendously in recent years, and demand continues to grow. There is a common belief in the spectrum policy community that spectrum secondary markets have “failed.” This belief is rather at odds with existing evidence. A simple perusal of the FCC’s “Daily Digest” shows a steady stream of filings reflecting spectrum leasing activity across numerous bands. Spectrum Bridge reports that it has brokered “tens of millions of dollars” in secondary market transactions in 2009. Industrial users have reported that demand for non-CMRS uses is increasingly unmet by existing allocations, and that they are turning to existing secondary markets to meet the need. As a consequence of these and other comments in the National Broadband Plan proceeding, the FCC has announced that it will commence a proceeding on how to further facilitate the use of secondary markets.

Private sector investment also suggests strong interest in spectrum secondary markets. The hedge fund Harbinger Capital Networks has announced an investment of billions of dollars to develop existing satellite spectrum in which it has rights to create a wholesale leasing network. The proposed network in many ways replicates the proposal by Frontline to create a wholesale network via the 700 MHz D block, indicating that at least some significant investors remain convinced that the failure of Frontline came from other factors – such as the cost of bidding at auction and the uncertainty of working with the Public Safety Spectrum Trust – rather than from a lack of demand for leased spectrum. Indeed, in the short time since Harbinger announced its plans, rumors have surfaced in industry press of a possible deal to lease the spectrum to T-Mobile.¹⁸

The focus in spectrum policy on CMRS spectrum, we believe, has clouded the perception in policy circles on the existing widespread use of existing secondary markets and the signs of continued growth in this sector. We should therefore observe that even CMRS licensees are finding access to non-CMRS spectrum a useful supplement to their licensed spectrum. Whereas CMRS providers had initially resisted including the capability to access unlicensed spectrum in their phones, they have now wholeheartedly embraced the use of unlicensed as a means of handling increasing demand for data traffic. In perhaps the ultimate culmination of this trend, AT&T has announced it will build a WiFi hotspot in New York City's Times Square expressly for its subscribers to take data traffic off of its overburdened licensed network.

While CMRS providers would obviously prefer more licensed spectrum, they appear increasingly willing to entertain other options to supplement existing systems – including leasing access to spectrum. When combined with the comments of industrial users and wireless ISPs (WISPs) for access to spectrum protected from interference, the case for market demand would seem to be adequately proven.

Federal secondary markets provide adequate spectrum to raise revenue. Would this increasing demand for private spectrum translate into demand for federal spectrum leases, particularly given the fragmented and uncertain nature of federal use? The database system permitting opportunistic use of federal spectrum alleviates many of the concerns that spectrum leasing is impractical, or would fail to attract sufficient interest because of the inability to guarantee access to sufficient spectrum.

The critical aspect of our proposal is that it moves from the current model used in the commercial sector in which individual licensees make spectrum available in specific bands to a model that makes all unused “white space” available all the time. The range of federal spectrum, from 30 MHz to 300 GHz, covers a great deal of spectrum capacity. As spectrum analyzer tests have shown time and again, the vast majority of this capacity remains unused at any given moment. Because the proposed system allows devices to maintain capacity by jumping from band to band as actual federal spectrum use shifts, the system provides adequate reliability for commercial use. While some users will undoubtedly prefer other alternatives, a federal secondary market can prove quite profitable serving only a portion of the market for spectrum access, given its projected exponential growth.

¹⁸ <http://www.goinglte.com/t-mobile-exploring-wholesale-deal-with-harbinger-1166/>

Proponents of auctions question whether secondary market revenue could match revenue obtainable through direct auctions. But this is a false comparison. Nothing in the proposed system prevents federal policymakers from identifying spectrum for auction and removing auctioned frequencies from the database. Again, because users would purchase capacity across a vast range of frequency bands, the removal of certain channels would not prove disruptive to existing secondary market users. While one would expect that the price paid in federal secondary markets would rise as more spectrum is removed from availability – whether by reallocation by auction, increased federal use, or allocation to free unlicensed service. From the perspective of maximizing federal revenue, such an outcome would be a win-win.

We recognize that both the Office of Management and Budget and the Congressional Budget Office would need to develop methods to estimate potential secondary market revenue, both to offset the cost of implementing the proposal and as part of calculating likely impact on the national debt. To begin this discussion, we have included an economic analysis for a hypothetical auction of spectrum in bands similar to those already auctioned for mobile and fixed wireless broadband use as against ten years of spectrum leasing revenue (see: "Technical Appendix"). Using accepted tools of estimating spectrum auction revenue, we determine that it is possible for the federal government to make *more* money over a ten-year period through leasing spectrum than through auctioning spectrum.

In the analysis, we recognize the preliminary nature of these findings. We do not claim that this proves that leasing will *always* be superior for raising revenue than traditional auctions. The study also assumes the standard leasing model rather than the dynamic model proposed here. At the same time, we also note that spectrum leasing, either using traditional models or the dynamic model proposed here, creates certain savings to bidders and federal users not reflected in most budget estimates. For example, no one has calculated the opportunity cost to the federal government from the lack of spectrum for necessary operations in the future, whereas such a cost is entirely avoided through leasing spectrum. Leasing spectrum also avoids the disruption of migrating federal users. This would not only save costs for both licensees and federal users, it would dramatically shorten the time between allocation and productive non-federal use. We anticipate that future studies will more clearly define the advantages of federal spectrum leasing, particularly dynamic leasing as proposed here.

Leasing would promote other federal objectives as well as revenue generation. Revenue generation is not the only federal policy. Even if leasing would generate less revenue than auctioning, the ability of leasing to advance other federal policy goals provides further justification for implementing a system of federal secondary markets. In particular, the ability of the proposed secondary market system to address spectrum demand, encourage innovative new uses of spectrum, advance spectrum technology – particularly the use of cognitive radio – and enhance competition in wireless markets weighs heavily in favor of adopting a secondary market system along the lines proposed here.

As supporters of enhanced access to unlicensed spectrum have observed, the flexibility and availability of unlicensed spectrum allows for innovation and competitive access in a completely different manner from that derived from licensed spectrum. The increasing cost of winning spectrum licenses – particularly in the most desirable markets – ensures that only the best capitalized market participants can hope to win desirable licenses. Even bidding credits for small businesses can only do so much to offset this economic reality. Furthermore, since a

license winner must pay the balance of the winning bid in a lump sum before receiving the license, successful bidders will have a strong incentive to maximize immediate financial return.

While supporters of auctions believe the incentive to maximize profit ensures that bidders will put spectrum to its “highest best use,” many industry stakeholders and non-commercial users argue that this dynamic inherently forecloses the development of non-commercial networks, and prevents the development of networks and technology with significant social utility. The development of complementary networks and technologies using unlicensed spectrum supports the view – now embraced by licensed users as well – that ensuring easy access to spectrum by means other than auctions plays an important role in the wireless ecosystem.

At the same time, however, unlicensed access lacks many of the advantages of licensed spectrum. The lower power levels permitted inhibit the ability to create unlicensed networks that cover significant geographic areas. Many commercial stakeholders have complained that the lack of interference protection for unlicensed access makes it unsuitable for certain applications, and unreliable for the provision of commercial services. Some have also expressed concern that the open nature of unlicensed spectrum makes it particularly vulnerable to overcrowding. While the often forecast “tragedy of the commons” has not emerged, it certainly the case that the limitations of unlicensed access limit innovation in the space in the same way that limitations on licensed spectrum limit innovation in the licensed space.

Federal secondary markets would combine many of the advantages of licensed spectrum and unlicensed spectrum. Leased spectrum would enjoy interference protection (accept against federal users) similar to licensed spectrum distributed by auction. At the same time, the availability of significant spectrum capacity in real-time should keep prices affordable for most stakeholders. The widespread availability of spectrum through “smart radios” would also stimulate the development of this technology, a long-standing federal goal.

While it appears at first glance that leased federal spectrum would not provide a basis for competing retail services, this spectrum would play an important role in facilitating competition by providing spectrum-constrained providers with access for backhaul and other purposes. This would allow these providers to use more of their licensed capacity for the direct provision of services, and provide alternatives to leasing spectrum from commercial rivals.

Secondary markets as part of a sustainable spectrum policy. Inclusion of federal secondary markets as a means of addressing spectrum access needs does not displace either exclusive licensing or unlicensed access. Rather, this additional tool provides a way to further federal policy, raise federal revenue, and relieve spectrum constraints on numerous stakeholders – especially those outside the CMRS industry.

V. CONCLUSION

Distributing exclusive licenses by auctioning built the modern cellular mobile industry in the 1990s. Enhanced access to unlicensed spectrum made the “WiFi revolution” possible in the 2000s. Though these allocation systems have proven complimentary in the real world, public policy debates remain gridlocked in an artificial choice between them. Worse, neither can adequately address the skyrocketing demand for wireless capacity from commercial, non-commercial, and government users.

Since 2004, secondary market transactions have emerged as an important way to address rising demand for wireless capacity. Federal policy must move past the traditional models, supported by traditional excuses and perspectives that have left federal spectrum management paralyzed by a false dichotomy between auctions and unlicensed access. The rise of commercial secondary markets and the availability of modern wireless technology could pave the way for another revolution in allocation, with the capacity to create a sustainable spectrum policy for the 21st Century.

TECHNICAL APPENDIX:

Estimation of Potential Revenue Accruing to the Treasury by Leasing of Hypothetically-Cleared Spectrum in the 2025-2110 and 2200-2290 Bands on the Secondary Market

A Report Prepared for Public Knowledge by:

Dr. Gregory Rose

Econometric Research and Analysis

and

Harold Feld

Legal Director, Public Knowledge

December 29, 2009

Introduction

This paper seeks to test whether the federal government would benefit from an ability to lease spectrum via a secondary market system similar to that created by the Federal Communications Commission (FCC) for FCC licensees in 2003.¹⁹ The paper assumes an “ideal case” of 45 MHz cleared on paired bands, proximate enough to bands recently auctioned so as to permit estimation. The 2025-2110 MHz band, located and 2200-2290 MHz. By employing a regression analysis based on auction revenues in comparable bands data available from the approximately five years of secondary market leasing activity since the FCC’s *Secondary Markets Order*, the paper concludes that the federal government would realize greater revenue from leasing spectrum access over time rather than auctioning the spectrum in a standard “big bang” auction.

The authors do not suggest that this analysis proves definitively that the federal government would always realize greater revenue from leasing than from auctions. Nor do the authors suggest that the determination of whether use of auctions, secondary markets, or opportunistic sharing with no cost for access better serve the competing goals of the Communications Act should rest on a revenue determination. Rather, the authors intend this paper to serve as a starting point for a serious examination of the role federal spectrum secondary markets could play in enhancing spectrum access. Because federal law,²⁰ as well as practical political considerations in a time of federal deficits, requires consideration of how management of federal spectrum will enhance federal revenue, the authors constructed this “ideal case” comparison to provide a baseline for consideration along the lines of federal revenue enhancement.

The results of the analysis illustrate that federal secondary market flexibility could provide significant enhancement to federal revenue and could serve as a valuable compliment to secondary market transfers via auctions. The FCC and NTIA should therefore explore whether it would advance the goals of

¹⁹ See *Promoting Efficient Use of Spectrum Through Elimination of Barriers to the Development of Secondary Markets*, 18 FCC Rcd 20604 (2003).

²⁰ See 47 U.S.C. §922(1).

federal policy to create a regime for leasing federal spectrum capacity similar to that created by the FCC for FCC licensees.

Background

Although Congress has prohibited licensees from “owning” spectrum since the Federal Radio Act of 1927, the FCC has generally allowed licensees to make spectrum available via a narrow class of permissible secondary market mechanisms. Notably, the FCC permitted parties transferring spectrum licenses, subject to FCC approval under Section 310(d), to receive compensation for transfers that clearly included the value of license despite the legal prohibition on “selling” FCC licenses. Over time, the FCC permitted more explicit experiments in secondary market mechanisms by allowing some services to explicitly lease capacity for various purposes.²¹ Finally, in 2003, as part of a general effort to increase spectrum access through reliance on market mechanisms, the FCC officially sanctioned secondary market transactions whereby licensees could, subject to their service obligations, lease spectrum.

Under the current regime, licensees enjoy considerable flexibility in the leasing arrangements into which they may enter. Indeed, the Commission decisions permitting secondary market transaction regarded this flexibility as an important element in promoting more efficient spectrum access. Licensees may partition their license areas, choosing to lease capacity for only a portion of the geographic coverage of the license. Licensees may auction access in real-time and create a “private commons,” may license capacity for a fixed term, or may make other arrangements based upon the commercial needs of the parties. The Commission requires only minimal reporting of these quasi-transfers to comply with statutory requirements, and primarily limits the arrangements of licensees by holding licensees ultimately responsible for complying with all limits and obligations imposed on the license. *i.e.*, A licensee is not

²¹ For example, in the 1980s, the FCC permitted broadcasters to lease capacity in the vertical blanking interval (VBI) for datacasting. In the 1990s, the FCC actively encouraged non-commercial users of 2.5 GHz spectrum to lease capacity to commercial users in the hopes of creating a “wireless cable” service, and subsequently to create the commercial Broadband Radio Service.

excused because a license violation was committed by a lessor or because a lessor failed to provide adequate service.

Since 2003, the use of spectrum secondary markets for those leasing spectrum has grown considerably. In recent comments to the FCC, Spectrum Bridge, a broker of secondary market agreements between licensees and those seeking to lease spectrum capacity, reported that it “has successfully completed tens of millions of dollars of secondary market transactions in 2009 alone.”²² Clearly, many entities find it useful to lease spectrum rather than to buy and sell it. Reasons for this on the part of those seeking to lease rather than purchase may include the high cost of winning licenses at auction, a need for access to spectrum for a limited period of time, a need for narrowly tailored geographic access, and a desire to avoid broader service obligations. For those seeking to lease excess capacity, leasing offers a way of generating revenue and meeting service/build out requirements for spectrum acquired and held in reserve against future need. Indeed, as described below, leasing spectrum often permits licensees to earn a premium on the leased portion of the spectrum over what sale of equivalent capacity would earn.

Would Secondary Markets Work For Federal Spectrum?

The success of the FCC’s secondary market regime raises the question of whether similar secondary market flexibility would provide a useful mechanism for enhancing access to spectrum currently dedicated to federal use on an exclusive or predominant basis. From an economic perspective, secondary market mechanisms for federal spectrum are equivalent to those that existed for FCC licensees prior to 2003. From time to time, the federal government will clear bands of spectrum for auction by the FCC. Although the Communications Act provides that this auction does not create an ownership interest in the license, the effect of the auction replicates the effect of a private “sale” of an FCC license subject to Section 310(d). Federal users must vacate the spectrum auctioned. Even if the federal government for some reason cancels the license obtained at auction, access to the spectrum does not revert back to the

²² Comments of Spectrum Bridge, Inc., GN Docket Nos. 09-157, 09-51 (filed September 30, 2009).

previous federal users. From an economic standpoint, for all intents and purposes, the federal government can either “sell” spectrum via auction or hold it for its own use.

What would be the impact of permitting the federal government to lease spectrum capacity with the same flexibility currently enjoyed by FCC licensees? Given the lack of available literature on this question, this paper will begin with the simplest question – would permitting secondary market flexibility enhance federal revenue generation as compared to an auction?

Assumptions Underlying Hypothetical Test Case

The analysis will consider an ideal case of two bands allocated for federal use either on an exclusive basis or mixed basis with non-federal users. According to the federal spectrum report published by the NTIA in 2008, the 2025-2110 band is used by NOAA and NASA for satellite uplinks, and by non-federal users for mobile news gathering services. NOAA has exclusive use of the 2200-2290 MHz band for radar. The analysis will assume that the federal government will clear 45 MHz paired between the two bands. Although this arguably eliminates a significant advantage of leasing over auctions, the ability to avoid expensive relocation of users, it will also eliminate the need to develop complex models that account for variable conditions within the band designed to avoid interference with existing federal users. Further, as explained below, assuming clearance of the band will facilitate direct comparison with the AWS-1 auction, which involved cleared, paired federal spectrum with similar characteristics.

Estimation of Potential Auction Revenues

The first step toward evaluating revenues accruing to trading spectrum on the secondary market is to establish the potential level of revenue accruing to that spectrum from clearance at auction. For purposes of exemplification, we assume that the two bands we have selected -- 2025-2110 and 2200-2290 – can be cleared in such a way that half the bandwidth can be leased to non-NOAA uses by FCC spectrum auction. This would result in 42.5 MHz and 45 MHz, respectively, being available for national licensing and auction. The optimal geographical units in which to license this spectrum is an empirical question

which we shall address shortly. Before that issue can be resolved we must attempt to answer whether this bandwidth share more vital characteristics with the 2.5 GHz BRS spectrum to which it is adjacent or to the potential AWS-2 spectrum to which it is also adjacent, for this will determine the comparanda on which evaluation of auction revenues will depend. It is likely that either the market will evaluate this spectrum in the same way it has evaluated spectrum in Auctions 6 and 86, which have allocated BRS spectrum, or the market will evaluate it in roughly the same way it has evaluated AWS-1 spectrum in Auction 66.²³ It is not, however, necessary to resolve this quandary by postulation. It is possible to create a dataset based on all three auctions – 6, 66, and 86 – which can be used for regression analysis and which will allow estimation of a range of estimates depending on whether the hypothesized revenue will be closer to that obtained in Auctions 6 and 86 or that in Auction 66.

The initial regression equation will take the form of:

$$\ln P_i = a + b_1 \ln POP + b_2 \ln MHz + b_3 \ln POP * \ln MHz + b_4 BRS + b_5 AUC86 + b_6 EA + b_7 CMA + b_8 REAG + e, \quad (1)$$

where $\ln P_i$ is the natural logarithm of the clearing price of license i , $\ln POP$ is the natural logarithm of the population of the geographic unit of license i , $\ln MHz$ is the natural logarithm of MHz in which license i is denominated, $\ln POP * \ln MHz$ is the interaction effect of the natural logarithms of population and MHz, BRS is a dummy variable scored 1 if license i was at auction as a BRS license, 0 if an AWS license, $AUC86$ is a dummy variable scored 1 if license i was auctioned in Auction 86, EA is a dummy variable scored 1 if the area in which license i was auctioned was an Economic Area,²⁴ CMA is a dummy variable scored 1 if the area in which license i was auctioned was a Cellular Market Area, $REAG$ is a dummy

²³ Since the AWS-2 auction has not yet occurred, we have only AWS-1 data available. Use of this data will probably result in overestimation of revenues since financial markets were not nearly so constrained in 2006 as they are today.

²⁴ These are names for geographic coverage area of spectrum licenses set by the FCC. Economic Areas (EA) are somewhat larger than Cellular Market Areas (CMA) and Regional Economic Area Groups (REAG) are significantly larger than either EAs or CMAs. The units in which BRS licenses were auctioned are Basic Trading Areas; no dummy variable for this geographic coverage area was included because it would be collinear with BRS .

variable scored 1 if the area in which license i was auctioned was Regional Economic Area Grouping, and e is the disturbance term.

These independent variables were chosen for a variety of reasons. First, population of the geographic area of the license and MHz in which the license are denominated, as well as their interaction effect, have been established as key predictors of the price at which the license will clear. Second, *BRS* was chosen to test for differences between BRS and AWS prices. Third, *AUC86* was chosen to test whether the slight discount at which BRS licenses in Auction 86 cleared is statistically significant. Finally, *EA*, *CMA*, and *REAG* were included to test for differences in price based on geographic area of coverage of license.

The independent variables were regressed on the dependent variable with the results presented in table 1.²⁵

Table 1. Regression Results

Variable	Estimated Coefficient	Standard Error	T-statistic	P-value
Intercept	-29.9355	1.3037	-22.9622	<0.0001
lnPOP	2.9616	0.0865	34.2585	<0.0001
lnMHz	8.4087	0.3687	22.8037	<0.0001
lnPOP * lnMHz	-0.5333	0.02512	-21.2151	<0.0001
BRS	-2.312	0.2843	-8.1325	<0.0001
EA	0.9386	0.1767	5.3126	<0.0001
CMA	0.9733	0.1959	4.9683	<0.0001

Variables *AUC86* and *REAG* were dropped from the equation because their coefficients

²⁵ Ordinary Least Squares (OLS) regression was used.

failed to meet the threshold for statistical significance. All the remaining coefficients were significant at $p < 0.0001$. The entire model was significant at $p < 0.0001$ (T-statistic = 971.0826) and the R^2 of the model was .8071. These results suggest that the model fits the data well and will be an effective estimator of potential auction revenue.

We first estimated revenues under the assumption that the market will evaluate this spectrum similarly to BRS spectrum. The predicted value of any license to be auctioned for 493 Basic Trading Areas was calculated as:

$$\ln P_i^{\wedge} = b^{\wedge} X^{\wedge}, \quad (2)$$

where the caret “ \wedge ” indicates a predicted value and X is a vector of regressors relevant to BRS-like spectrum. We assumed that the spectrum would be auctioned in two blocks in recognition of the two different bandwidths. Hence the predicted value of each block was

$$R_i^n \ln P_i^{\wedge} \quad (3)$$

where n is 493. The two blocks were then summed for a final estimate of revenues under this assumption. The predicted revenue accruing from auctioning of 42.5 MHz and 45 MHz of 2025-2110 and 2200-2290, respectively, in 493 BTA units was \$147,766,005.²⁶

We next estimated revenues under the assumption that the market will evaluate this spectrum similarly to AWS-1 spectrum auctioned in EA units. The predicted value of any license to be auctioned for 173 Economic Areas²⁷ was calculated as:

$$\ln P_i^{\wedge} = b^{\wedge} X^{\wedge}, \quad (2)$$

²⁶ This is likely to be an underestimate of revenue, since the BRS spectrum allocated in Auction 6 and 86 was partially encumbered by potential interference from previously allocated P35 BRS and EBS licenses. However those two auction represent the only opportunity for evaluation of the spectrum by a primary market and, thus, the only price comparanda. The P35 licenses were issue before the FCC initiated spectrum auctions.

²⁷ The EA and CMAs covering the Gulf of Mexico were excluded because there is no census data from which to calculate $\ln POP$.

where the caret “^” indicates a predicted value and X is a vector of regressors relevant to AWS-1-like spectrum auctioned in EAs. We assumed that the spectrum would be auctioned in two blocks in recognition of the two different bandwidths. Hence the predicted value of each block was

$$R_i^n \ln P_i^{\wedge} \quad (3)$$

where n is 173. The two blocks were then summed for a final estimate of revenues under this assumption. The predicted revenue accruing from auctioning of 42.5 MHz and 45 MHz of 2025-2110 and 2200-2290, respectively, in 173 EA units was \$4,103,065,159.²⁸

We finally estimated revenues under the assumption that the market will evaluate this spectrum similarly to AWS-1 spectrum auctioned in CMA units. The predicted value of any license to be auctioned for 733 Cellular Market Areas was calculated as:

$$\ln P_i^{\wedge} = b^{\wedge} X^{\wedge}, \quad (2')$$

where the caret “^” indicates a predicted value and X is a vector of regressors relevant to AWS-1-like spectrum auctioned in CMAs. We assumed that the spectrum would be auctioned in two blocks in recognition of the two different bandwidths. Hence the predicted value of each block was

$$R_i^n \ln P_i^{\wedge} \quad (3')$$

where n is 173. The two blocks were then summed for a final estimate of revenues under this assumption. The predicted revenue accruing from auctioning of 42.5 MHz and 45 MHz of 2025-2110 and 2200-2290, respectively, in 733 CMA units was \$4,201,703,372.

²⁸ Both this and the following calculation are likely to be slight overestimates of actual revenues at auction, since AWS-1 spectrum was not encumbered by rigorous build-out requirements to prevent spectrum warehousing and since the latest 700 MHz auction it is unrealistic to assume that the FCC will not impose build-out conditions. Furthermore, it is unlikely that financial markets will be as robust a support to the capitalization of bidders in future spectrum auctions as they were for Auction 66. Both factors will tend to reduce price somewhat.

We must now examine the ways in which relevant spectrum – the spectrum at auction in Auctions 6 and 86 and in Auction 66 – is cleared in the secondary market at a premium or discount in relationship to its clearing price at auction, since that will help us evaluate the potential revenue from offering the hypothesized spectrum on the secondary market.

Secondary Market Transactions

Secondary market transactions occur in various venues, ranging from private negotiations between in-house or external counsel of the licensee and the leasee²⁹ to electronic auction-like facilities provided by firms like Spectrum Bridge's SpecEx subsidiary. While the FCC requires notification and approval of all secondary market transaction involving spectrum licenses, the FCC rarely disapproves such transactions. Unfortunately the FCC's rules do not require disclosure of the price at which the license cleared in the secondary market. However, it is frequently possible to ascertain that price through press coverage, press releases of the involved parties, and industry analyst studies.

What is likely the most lucrative secondary market transaction is the acquisition of spectrum in the 700 MHz band by ATT&T from Aloha Partners just prior to Auction 73 for \$2.5 billion. Aloha Partners had paid \$34,853,070 for rights to the spectrum in Auctions 44, 49, and 60. The price paid by AT&T represents a premium of 7072.97% over Aloha Partners' outlay to obtain the spectrum at auction. Such windfalls, however, are extremely rare and must be treated as anomalous cases.

Secondary markets are particularly efficient as a result of their being able to aggregate and disaggregate partitions of any particular license, making it possible for customers to lease exactly and only the amount of spectrum needed for the specific time period. Railroads have made particular use of this function of secondary markets to gain coverage of narrow bands of spectrum contiguous to railbeds. Large sporting events have also availed themselves of the secondary to obtain additional spectrum for short-duration occasions. Similarly construction companies are able to lease limited amounts of spectrum

²⁹ The vast majority of secondary market transactions are de facto lease transfers of spectrum licenses.

for the duration of the construction project and no longer. Secondary markets have also been used by major corporations like Clearwire to assemble national footprints in P35 BRS and EBS licenses in the 1.5 GHz band for its WiMax deployment. Secondary markets, thus, provide efficiencies and opportunities to tailor to client which primary markets like auction are simply incapable of realizing under current rules. In particular the revenue stream from secondary markets is dependent on use: clients pay only for what they use and the duration of the lease by which they use it; the warehousing of spectrum becomes a liability rather than an advantage under the rules under which they operate.

Estimation of Potential Secondary Market Revenues

It is necessary to compare the price of spectrum at auction to the price of similar spectrum at offer in a secondary market to determine the premium or discount which offering on a secondary market presents for potential lessors and leasees. The standard method for comparison of spectrum is the dollar/MHz/population standard under which the total net dollar amount fetched by the spectrum is divided by the number of MHz at offer and by the population covered by the spectrum. When there are many licenses at offer in an FCC auction, the most common standard measure is mean dollar/MHz/population and this standard will be used here.

BRS spectrum cleared in Auction 6 with a mean dollar/MHz/population of \$0.0183. BRS spectrum cleared in Auction 86 with a mean dollar/MHz/population of \$0.0192. Using data from new reports, press release by principals, industry analysts, and data provided by SpectrumBridge, Inc., it was possible to compile a dataset of the prices fetched by 675 BRS licenses which have been traded on secondary markets. The mean dollar/MHz/population obtained by those licenses on secondary markets in 2007-2009 was \$0.1617, a premium of 783.61% over the mean dollar/MHz/population obtained in Auction 6 and a premium of 742.19% over the mean dollar/MHz/population obtained in Auction 86. Applying these premiums to projected auction revenues to be obtained from auction of the 2025-2110 and

2200-2290 bands, we arrive at a range of revenues of \$1,096,700,818 to \$1,157,904,105, depending on which premium most closely models the premium for leasing of the 2025-2110 and 2200-2290 bands.³⁰

AWS-1 spectrum cleared Auction 66 at a mean dollar/MHz/population of \$0.1852. Trading of AWS-1 spectrum has been far less brisk than BRS spectrum, partly because so much of it remains warehoused by the major bidders as they analyze how to integrate the spectrum into their existing systems. However, a database of 39 licenses which have been leased on secondary markets and the prices which they have fetched has been assembled from new reports, press release by principals, industry analysts, and data provided by SpectrumBridge, Inc. The mean dollar/MHz/population at which this AWS-1 spectrum has cleared on secondary markets is \$0.5683. This represents a 206.86% premium over price cleared at auction. Applying these premiums to projected auction revenues to be obtained from auction of the 2025-2110 and 2200-2290 bands, we arrive at a range of revenues of \$8,487,600,588 to \$8,691,643,595, depending on whether the 2025-2110 and 2200-2290 bands are allocated in EA or CMA units.³¹

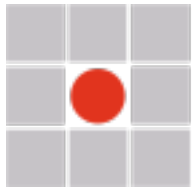
Conclusion

It is apparent that the hypothesized leasing of cleared spectrum in the 2025-2110 and 2200-2290 bands would be more lucrative if traded on the secondary market rather than by traditional FCC spectrum auction. Depending on how the market evaluates that spectrum, i.e., whether the market regards the appropriate comparandum of this spectrum as being the BRS 2.5 GHz band or the AWS-1 spectrum, and depending on the geographic aggregations in which the spectrum is offered, projected revenues from leasing of this spectrum on the secondary market range from \$1,096,700,818 to \$8,691,643,595. These are significantly higher than the projected revenues from FCC auction of the same spectrum, which is in

³⁰ It is probable that these estimates slightly overestimate revenues since the premiums accruing to BRS spectrum on the secondary during the period in question were somewhat inflated by Clearwire's use of the secondary market to obtain national footprint for its WiMax deployment.

³¹ The relatively small n of AWS-1 licenses which have been traded on secondary markets makes these estimates less reliable than the estimates based on the market evaluating the 2025-2110 and 2200-2290 bands as more similar to the BRS spectrum.

the range of \$147,766,005 to \$4,201,703,372, depending, again on market evaluation and geographic aggregation.



Public Knowledge

**Breaking the Logjam:
Some Modest Proposals for Enhancing Transparency,
Efficiency and Innovation in Public Spectrum
Management**

Harold Feld

Dr. Gregory Rose

I. INTRODUCTION

The dramatic rise in demand for wireless capacity has once again focused discussion on the management of federal spectrum. Mobile wireless providers hope to find additional federal spectrum to clear and auction. Technology companies and advocates of open spectrum policies hope to identify ways in which non-federal users can access federal spectrum in non-interfering ways via “opportunistic sharing.” But a lack of clarity surrounding how federal agencies allocate spectrum access and utilize wireless technologies hampers the effort to move forward with any policy.

This lack of clarity flows from a variety of sources. Chief among them is a legal framework that places the National Telecommunications Information Administration (NTIA) in the nominal position of manager of federal spectrum, while making spectrum utilization a matter of individual agency discretion. The result is that while we speak of “federal spectrum” as a single managed resource, it is instead managed in isolated and discrete bits with relatively little overall coordination beyond interference avoidance. Concerns over national security further complicate efforts to enhance overall transparency.

At the same time, the current system creates perverse incentives for federal spectrum managers to limit transparency and oversight. Historically, the only reward for operating with greater transparency and efficiency is to have spectrum reallocated for auction. Indeed, industry stakeholders and federal officials have repeatedly stated that the driving purpose for enhancing transparency is to facilitate transfer of spectrum from federal use to commercial use, preferably by clearing large bands of paired spectrum in the range most desirable for cellular providers. The resistance of federal spectrum managers is further compounded by proposals that emphasize punishing and compelling agencies to give up spectrum through such mechanisms as spectrum fees, and which appear utterly indifferent to the growing need for federal wireless capacity for the delivery of services.

The result is a logjam in federal spectrum policy that goes beyond the impact on the private sector. Federal spectrum management remains frozen, unable to take advantage of changes in technology or leverage economies of scale. Basic planning for serving expanding federal needs is hampered, agencies lack modern equipment, and agencies are locked into antiquated systems, unable to take advantage of the flexibility that has become the hallmark of private sector wireless use, from the iPhone to unlicensed mesh networks.

In an effort to break the policy logjam, we make a number of recommendations for enhancing transparency and coordination among federal users who work within the existing framework of federal law.¹ The recommendations begin with simple reform of the NTIA’s processes and its relationship with the FCC. As a next step, we propose that the Administration use existing legislative authority to “zero base” the federal “spectrum budget” by requiring every agency to reapply for its spectrum allocation, including specific details with regard to spectrum utilization. The President should also, by Executive Order, require all agencies to execute five-year “spectrum plans” that would set forth projected need and allow for coordinated planning

¹ We recognize that national security issues will need to be addressed in the context of all of these proposals.

among agencies. The NTIA, working with the Chief Technology Officer (CTO), would provide coordination and support to agencies.

While this imposes significant burdens on federal agencies, such action constitutes a critical first step toward developing a coherent federal spectrum policy that will ultimately enhance federal use and result in significant cost savings. With this information in hand, the NTIA, working with the CTO, the Office of Management and Budget (OMB) and the General Services Administration, can commence long-term spectrum planning on a government-wide basis that would transition the federal government (to the extent possible) from relying on discrete quasi-license-like assignments to dynamic assignment of flexible wireless capacity on an as needed basis. In addition, the NTIA and the FCC would convene state and local governments to determine how to promote interoperability and develop a set of best practices for management of wireless at all levels of government.

We stress that for these proposals to succeed ***the political leadership must embrace enhancing transparency and public involvement in spectrum policy as a value for its own sake***, not merely as a means of moving spectrum from federal use to commercial use. While enhanced transparency and public oversight of federal spectrum will almost certainly result in an increase in the wireless capacity available to the private sector, the federal government and Congress must commit that a primary goal of federal spectrum management reform is to ensure that all federal agencies will have access to the wireless tools critical to success in the 21st Century.

Specifically, we propose:

- The NTIA and the Federal Communications Commission (FCC) should expand the cooperation required between the agencies by statute. In particular, the agencies should publish an annual joint spectrum plan based on the mandatory consultation between the Chairman of the FCC and the Administrator of the NTIA,² and should clarify the “expedited” process mandated by statute for processing applications for mixed federal and non-federal use.³
- The NTIA should take steps to improve opportunities for public involvement in its spectrum management decisions, and should launch its own e-government initiative, similar to the Reboot.FCC.Gov.
- The NTIA, the Secretary of Commerce, and the Director of the OMB should “zero base” federal spectrum use, requiring all federal agencies to reapply for spectrum allocations. Failure to reapply, and provide adequate detail on use, will result in elimination of existing spectrum allocation.

² 47 U.S.C. § 922.

³ 47 U.S.C. §§ 903(b)(5), 927(2).

- The President should require all agencies to prepare a “spectrum budget” in the same manner they prepare a federal budget, assessing existing and future needs. The NTIA would serve as coordinator for these agencies and would provide technical support, assisted by the federal Chief Technology Officer (CTO) and the Office of Management and Budget (OMB).
- Based on these exercises, the CTO, with support from the NTIA, would assist agencies in upgrading wireless equipment and enhancing the use of spectrum resources for individual agencies, in order to enhance their overall missions.
- The Federal CTO, working with the NTIA and other federal agencies, should develop policies enabling and encouraging federal agencies to move from the current system of assigned spectrum allocations to a system leveraging new technologies to permit dynamic assignment to agencies on an “as needed” basis. In essence, the federal government would transition from a system in which agencies hold the equivalent of a spectrum license to one where the federal government manages a vast pool of wireless capacity from which agencies may “draw” as needed.
- The NTIA and the OMB should conduct a comprehensive review of existing federal statutes to determine how private entities can make contributions to federal agencies to enhance federal spectrum efficiency and promote innovative use of wireless resources by the federal government. The review should also seek to establish ways to further enhance public transparency and accountability with regard to spectrum use.
- The NTIA and the FCC should work with state and local governments, and their trade associations, to find ways in which federal, state and local governments can enhance emergency communications and spectrum efficiency, and promote innovative uses of wireless technology at all levels of government.

II. THE INTEREST OF THE PUBLIC IN FEDERAL SPECTRUM MANAGEMENT

Interest in federal spectrum has generally focused on how to enhance non-federal access to spectrum allocated on a primary basis to federal users. In particular, wireless service providers have urged the federal government to clear additional bands, in order to auction more licensed spectrum to meet the ever-increasing demand from consumers and businesses. In recent years, advocates of increasing unlicensed spectrum access have also sought greater transparency and efficiency in federal spectrum management.

But the value of enhancing transparency and efficiency in federal spectrum management goes well beyond making more spectrum available for non-federal users. Every citizen of the United States has the same interest in seeing the federal government use wireless to enhance the delivery of federal services as we do in seeing federal money wisely spent and natural resources properly developed. Federal agencies use wireless for a wide variety of purposes ranging from

national security to internal communications to tracking the weather. Modernizing federal use of wireless can vastly improve public welfare by allowing federal agencies to deliver new services, improve the overall efficiency of old services, and generally stimulate the development of new wireless technologies and economic growth. For example, the development by the Department of Defense of the Global Positioning System (GPS), and the decision to make GPS available freely to the public, not only enhanced the efficiency of federal operations, it created an entire civilian industry.

In addition, although “spectrum” is an artificial construct used to describe the right to transmit on specified electronic frequencies at specified power levels, we continue to view spectrum as a “national resource.” We have therefore made it a cornerstone of federal policy that use of “the public airwaves” must serve the broader public interest. This broader public interest includes a wide range of identified interests from protecting public safety, to ensuring that federal services are delivered in innovative and cost effective ways, to reducing costs for federal operations by reducing the need to pay private sector providers.

Any effort to enhance the efficiency of federal spectrum management must start with an understanding of how the federal government uses spectrum today. In theory, the National Telecommunications Information Administration (NTIA) manages federal spectrum under a set of procedures contained in the *Manual of Regulations and Procedures for Federal Radio Frequency Management*.⁴ But while we speak of “federal spectrum” as if it were one centrally managed resource, “federal spectrum” consists of hundreds of allocations for use by nearly all federal departments or agencies, with no mechanism for tracking use. This fragmentation of management costs the federal government billions of dollars in inefficiency and opportunity cost. Agencies struggle with antiquated and inefficient equipment because they lack the funds to upgrade and because the reward for efficient use of spectrum is to have spectrum capacity reallocated elsewhere. The arcane nature of the federal spectrum allocation process contributes to a culture within the federal system where a handful of spectrum managers in each agency make decisions without any form of effective oversight, subject to the specific demands of their own agencies, and resistant to efforts to impose any kind of overall federal policy.

The persistence of this state of affairs for many years, despite strong consensus around the need to enhance transparency among industry stakeholders, academics and advocates, members of Congress, and political appointees demonstrates that the problem admits to no easy solution. The effort by leaders in both houses of Congress to pass bills that would enhance transparency of federal spectrum management and ease the ability of future auction winners to migrate federal users to clear bands post auction has been met with difficulty, despite broad stakeholder and bipartisan support. Even if the pending bill mandating an inventory of federal spectrum and the creation of a publicly accessible database passes, the NTIA will still need to resolve the problem of compelling federal agencies over which it has no authority to cooperate.

⁴ Also called the “Red Book” because of its red cover. Available at: <http://www.ntia.doc.gov/osmhome/redbook/redbook.html>

III. REASONS WHY TRANSPARENCY REMAINS ELUSIVE

Given all the positive reasons for transparency, why has it remained so elusive? The answer lies in the peculiar combination of legal circumstances and institutional incentives at play.

Although the Communications Act centralizes authority for federal assignment in the President,⁵ delegated to the Assistant Secretary for the NTIA,⁶ management of federal spectrum requires a complex balancing between the current needs of federal agencies, and their possible future needs. Further, although the NTIA has a general coordination responsibility, generally exercised by its hosting of the Interdepartmental Radio Advisory Committee (IRAC), the NTIA does not have direct authority over the agencies it authorizes to use particular allocated frequencies. National security concerns, and the difficulty involved in anticipating the range of agency uses, further complicates efforts to promote transparency.

At the same time, one cannot ignore the institutional incentives for agencies to maintain the current lack of transparency as a means of protecting institutional goals. Historically, greater transparency and efficiency by federal users has been rewarded with the transfer of spectrum from federal users to the private sector. Lack of transparency facilitates an insular and defensive approach to spectrum management, where federal agencies seek to preserve their spectrum from private sector “poaching.” Given this choice of rewards, it should come as no surprise that rational federal spectrum managers would seek to maintain the status quo rather than seek to promote greater transparency and public input.

This element in the culture of federal spectrum management is perhaps best illustrated by the agency response when Congress explicitly instructed the NTIA to take steps to increase transparency in federal decisions on spectrum management in the Telecommunications Authorization Act of 1992.⁷ The statute directed the NTIA to modify the Red Book as follows:

- (1) provide for a period at the beginning of each meeting of the Interdepartmental Radio Advisory Committee to be open to the public to make presentations and receive advice, and provide the public with other meaningful opportunities to make presentations and receive advice;
- (2) include provisions that will require (A) publication in the Federal Register of major policy proposals that are not classified and that involve spectrum management, and (B) adequate opportunity for public review and comment on those proposals;
- (3) include provisions that will require publication in the Federal Register of major policy decisions that are not classified and that involve spectrum management;
- (4) include provisions that will require that nonclassified spectrum management information be

⁵ 47 U.S.C. § 305(a).

⁶ 47 U.S.C. § 902(b).

⁷ Pub. L. 102-538 §104, *codified at* 47 U.S.C. §903(a)-(b).

made available to the public, including access to electronic databases; and

(5) establish procedures that provide for the prompt and impartial consideration of requests for access to Government spectrum by the public, which procedures shall include provisions that will require the disclosure of the status and ultimate disposition of any such request.

The NTIA's response to this statutory directive can be found in Chapter 11 of the Red Book.⁸ It can be summarized as follows:

- (1) Most information can be obtained on the NTIA website.
- (2) Parties in need of additional information should file a Freedom of Information Act Request.
- (3) Parties wishing to make a presentation to the IRAC should use the website to find appropriate contact information, then submit a formal request.
- (4) Applications for access to federal spectrum will be forwarded to the FCC. The NTIA may or may not include written comments or recommendations to the FCC as part of this process.

This minimalist response to Congress' effort to enhance transparency and public input cannot be explained as a function of national security or by a lack of authority by the NTIA over other federal agencies. It is also interesting to note that since the beginning of the Obama Administration, other federal agencies, including the FCC, have launched significant transparency and civic engagement initiatives. But the NTIA has not. With the exception of opening meetings of the spectrum federal advisory committee to the public, the NTIA has made no significant changes in its processes, or announced any initiatives to promote greater transparency or facilitate public input in its spectrum management.

While one should not impute too much to the failure of an agency to allocate scarce resources to reforming its own processes and accountability, it is also understandable why critics of federal spectrum management have become frustrated and accuse the agency (and federal spectrum managers generally) of doing their best to obstruct efforts to enhance transparency and accountability.

IV. CONSEQUENCES OF THE GRIDLOCK: FEDERAL SPECTRUM MANAGEMENT REMAINS FROZEN, MISSING OUT ON NEW SPECTRUM TECHNOLOGIES AND OPPORTUNITIES FOR COST SAVINGS

As a result of the current system, the process by which agencies apply for spectrum allocation and use wireless capacity has remained virtually unchanged. This appears to have stifled innovation in federal wireless services. Federal agencies lack the necessary flexibility to

⁸ Available at <http://www.ntia.doc.gov/osmhome/redbook/11.pdf>

experiment with new “business models” for delivering service or meeting their needs. Even if they had this flexibility, however, a culture of innovation around wireless delivery does not exist (excluding those agencies, such as the Department of Defense, that have an explicit research component as part of their mission). For the vast majority of federal agencies, spectrum is an input for the purpose of fulfilling a specific function such as secure two-way radio communication, weather radar, or satellite uplink. There is no effort on an interagency level to consider how changes in wireless technology could revolutionize the delivery of federal services. To the extent individual agencies may be engaged in such thinking for themselves, it is done on an isolated and sporadic basis. There is no obvious effort, either at NTIA or elsewhere in the federal government, to facilitate such thinking.

The result is that the federal government is largely missing out on the wireless revolution. While demand for machine-to-machine wireless capacity and other industrial uses continues to rise, the federal government remains essentially static. Whatever opportunities the federal government could realize for economies of scale and other efficiencies are currently lost, with no mechanism for capturing them.

In addition, the lack of transparency has produced paralysis in the effort to make more spectrum available to non-federal users. Whether one favors clearing bands for auction or increasing opportunities for “mixed use” with federal users, the inability of stakeholders, advocates and decision makers to say with any certainty what the characteristics are for any band primarily allocated for federal use has made it impossible to determine how to proceed. Although parties can usually agree with generalities and overall goals, any set of recommendations can, and is, met with objections that cannot be evaluated because the information needed to adequately evaluate them does not exist.

V. MOVING FORWARD WITHIN THE EXISTING STATUTORY FRAMEWORK: NEW PERSPECTIVES AND NEW TECHNOLOGIES REQUIRE NEW APPROACHES

Moving forward to enhance federal spectrum management requires addressing the situation that has developed over the last several decades. Federal spectrum managers face increasing demand on their spectrum. They have every incentive to fight enhanced transparency, which generally “rewards” these efforts with loss of spectrum and the concomitant costs of leasing access from the private sector. Further, the current system, which fragments spectrum use across all federal agencies, remains an impediment to implementing new, interoperable technologies and achieving the efficiencies and cost savings that come from leveraging the vast size of the federal government.

Changing the federal culture requires leadership from the political branch. It also requires cooperation from non-federal stakeholders. An approach to federal spectrum reform geared solely to finding new spectrum to clear and auction will not only re-enforce the overall resistance by federal spectrum managers to change, it will result in policies that ill-serve the nation as a whole. New technologies permit the federal government to treat “federal spectrum” as a coordinated resource, assigning spectrum to agencies on an “as needed” basis without cumbersome application processes. This would undoubtedly require public investment in

upgrading available federal technology, but the benefits to the public in enabling more efficient delivery of federal services via wireless and the cost savings from improving overall efficiency appear likely to offset these expenditures – although one cannot say for certain until the federal government takes sufficient steps forward to make a proper assessment.

To begin moving forward, we recommend a number of initial steps to improve those processes under the direct control of the FCC and the NTIA. Not only are these steps the easiest to achieve, they also send a strong statement that the primary spectrum management agencies believe in transparency and public participation. Further, through facilitating the application process for commercial users to access federal spectrum consistent with existing federal use, the proposed reforms will also begin to address the overall issue of making more spectrum available for non-federal users.

As a second step, we recommend using the statutory powers conferred upon the President, the Secretary of Commerce, the Asst. Secretary for the NTIA, and the Director of the OMB, to “zero base” federal spectrum allocations and to require agencies to engage in spectrum planning in the same way they assess other resource needs. The NTIA and the CTO would assist agencies in these planning efforts and begin the process of encouraging cross-agency coordination and cooperation to achieve efficiencies and economies of scale.

Critically, this would provide a clear database for the public with regard to the use of federal spectrum and the projection of federal need. This would permit the debate to move to the third and final stage, the formulation of a coherent federal spectrum policy designed to maximize federal goals across all agencies, while providing non-federal users with accurate information with regard to access to spectrum.

VI. INTERNAL REFORMS AT THE NTIA AND THE FCC

The NTIA was directed by Congress in 1992 to make its spectrum management practices more transparent. As noted above, the NTIA has not invested significant resources into this effort, nor have any initiatives been announced since the change of Administration similar to the FCC’s efforts to increase accessibility. The NTIA website is both difficult to navigate and largely impenetrable to the layperson – the *Manual of Regulations and Procedures for Federal Radio Frequency Management* even more so. The times and agendas for IRAC meetings are not readily available. Indeed, public participation in IRAC deliberations is only permitted to the extent mandated by Congress, embodied in the ability to make presentations.

Even for the practitioner attempting to determine how federal frequency bands are used and managed, the NTIA website and Red Book are difficult to navigate. The most recent comprehensive report on federal spectrum use, the 2008 Federal Strategic Spectrum Plan,⁹ provides a description by agency of frequency bands used for specific purposes. To assemble a picture of a band primarily allocated for federal use, one would need to review the entire report and reconstruct it. Even this would not provide any technical details on how the agencies in question actually use the spectrum.

⁹ Available at <http://www.ntia.doc.gov/reports/2008/FederalStrategicSpectrumPlan2008.pdf>.

As an initial matter, therefore, NTIA could demonstrate a commitment to transparency and public input through the simple expediency of making its existing website more accessible. Indeed, the NTIA BTOP program provides a reasonable model for NTIA to replicate on the spectrum side. Even better would be a full commitment to implement social media and e-government tools, as has been done with the FCC's Reboot.FCC.Gov.

A. Specific Reforms

Beyond the general need to make existing NTIA information more accessible, the NTIA can enact several specific reforms to improve its processes.

Facilitate participation in IRAC. The NTIA should facilitate participation by the public in the deliberations of the Interdepartment Radio Advisory Committee (IRAC). It is safe to say that unless one knew precisely what the IRAC was, and why one wished to find it, a member of the public would be extremely unlikely to find the relevant webpage on the NTIA website. The rather minimal information provided invites members of the public to send, by email, a written request to brief the IRAC, or to attend a scheduled public briefing. No other access to the IRAC's deliberations is provided.

Provide Minutes or a Report on the Biannual Meeting Between the Assistant Secretary and the Chairman of the FCC to Conduct Spectrum Planning. Section 112 of the National Telecommunications Information Administration Organization Act¹⁰ requires the Assistant Secretary for the NTIA and the Chairman of the FCC to meet "at least Biannually" to conduct joint spectrum planning on how to make more spectrum available for non-federal users. The FCC and NTIA could jointly publish a report on or minutes from this exercise.

Provide a clear process for expedited consideration of mixed use applications. Section 117 of the NTIA Organization Act¹¹ permits the Secretary of Commerce to allow non-federal users to access bands "allocated on a primary basis for Federal Government use." The FCC is required to process such requests within one year. The NTIA and the FCC should work jointly to make this process accessible by non-federal users, and to decide on the applications within the time limit set by Congress.

These specific reforms, in addition to general reforms designed to encourage public participation and the accessibility of information, are entirely within the control of the NTIA and the FCC. The agencies can begin implementation immediately. This would both improve overall transparency and demonstrate an agency commitment to enhancing transparency and public participation.

¹⁰ 47 U.S.C. § 921.

¹¹ 47 U.S.C. § 927.

VII. ZERO BASE FEDERAL SPECTRUM ALLOCATIONS

In accounting, “zero based” budgeting is a planning technique used to re-examine traditional expenditures. Rather than simply continuing expenditures from previous years, zero based budgeting requires those seeking money to justify each request as if it were a new request for funds. Federal agencies have employed zero based budgeting to re-examine traditional modes of operation and to enhance public oversight by requiring a justification for each expense.

We propose that the federal government “zero base” federal spectrum allocations, and require every agency to reapply for a spectrum allocation. The Secretary of Commerce is explicitly authorized to “withhold or refuse to assign” spectrum allocations to federal users “to further the goal of making efficient and cost effective use of the spectrum.” 47 U.S.C. §903(d)(2). In addition, the NTIA may alter or eliminate an existing allocation to a federal user, subject to an appeal to the Office of Management and Budget. 47 U.S.C. §103(b)(2)(A); §104(d)(2). Finally, we note that Section 305(a) of the Communications Act centralizes authority over federal spectrum in the President. Although the President has delegated this authority to the Assistant Secretary for the NTIA, the President remains the ultimate source of authority over the ability of federal users to access spectrum.

To zero base federal spectrum, the President, the Secretary of Commerce, and the Assistant Secretary for the NTIA would jointly announce that all existing federal spectrum assignments are hereby cancelled on a specific date. All federal agencies would therefore be required to reapply for federal spectrum allocations, subject to approval by the Secretary of Commerce, the Assistant Secretary of the NTIA, and the Chief Technology Officer as the designee of the Director of the Office of Management and Budget. This one-time special process would completely bypass the IRAC and other standard procedures described in the Red Book. The same order would also require federal agencies to generate a “spectrum budget” similar to their annual budget requests.

This exercise would allow the NTIA and the Chief Technology Officer to achieve two goals. First, it would provide a comprehensive database of all federal users, at whatever level of granular detail desired, though the simple expediency of declaring any spectrum allocation not included in the database null and void. Federal agencies refusing to comply could not subsequently be heard to complain if “their” spectrum were reallocated.

More importantly, however, this exercise would transform federal spectrum management by allowing for a more active role for the NTIA and the Chief Technology Officer. As an initial matter, the NTIA and the CTO would need to provide technical assistance to other federal agencies for the application and initial “spectrum budgeting” process. Afterwards, the database would provide the necessary information for genuine federal spectrum planning.

VIII. AFFIRMATIVE SPECTRUM PLANNING BY THE NTIA AND THE CTO

The final set of recommendations concerns what should be the ultimate goal of federal spectrum management: moving from the existing system to one where federal agencies can enjoy flexibility and are encouraged to be innovative in their uses of wireless capacity, while still using

spectrum in an efficient manner.

As an initial matter, the CTO, with the assistance of the NTIA, should identify those federal agencies in need of wireless equipment upgrades and recommend ways of enhancing use of spectrum resources for individual agencies, in order to enhance their overall missions. Longer term, the Federal CTO, working with the NTIA and other federal agencies, should develop policies enabling and encouraging federal agencies to move from the current system of assigned spectrum allocations to a system leveraging new technologies to permit dynamic assignment to agencies on an “as needed” basis. In essence, the federal government would transition from a system in which agencies hold the equivalent of a spectrum license to one where the federal government manages a vast pool of wireless capacity from which agencies may “draw” as needed.

Contemporaneous with this, the NTIA and the OMB should conduct a comprehensive review of existing federal statutes to determine how private entities can make contributions to federal agencies to enhance federal spectrum efficiency and promote innovative use of wireless by the federal government. This review should also seek to establish ways to further enhance public transparency and accountability with regard to spectrum use. In particular, the NTIA and the FCC should work with state and local governments, and their trade associations, to find ways in which federal, state and local governments can enhance emergency communications, spectrum efficiency, and promote innovative uses of wireless technology at all levels of government.

IX. CONCLUSION

The continued logjam in federal spectrum management, caused largely by a lack of transparency, imposes huge costs. In addition to the obvious cost discussed in spectrum policy circles of limiting non-federal access to federal spectrum, the current lack of transparency preempts any ability of the federal government as a whole to enjoy those advances in wireless technology that have improved productivity and our quality of life outside of the federal sector. But enhancing transparency will require more than just implementation of the changes proposed here. It will require leaders who are willing to push aggressively to change the culture of federal spectrum management from one that punishes transparency and efficiency to one that welcomes transparency as a means of achieving federal policy goals beyond transferring spectrum to the private sector.